SCIENTIFIC RESEARCH ARTICLE

Relationship between whether the planned discharge destination is decided and locomotive syndrome for admitted patients in psychiatric long-term care wards

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ABSTRACT. Objective: We focused on locomotive syndrome as a low physical function factor that may prevent patients with psychiatric disease from being discharged. The purpose of this study is to clarify the factors, including locomotive syndrome, that prevent discharge from psychiatric long-term care wards.

Method: We enrolled 74 patients who were admitted to psychiatric long-term care wards at three different hospitals in Japan. Nurses or medical social workers in the ward were asked whether the planned discharge destination had been decided, and patients were categorized into a decided group and an undecided group.

Outcome measures were age, sex, F code in the ICD-10 Classification of Mental and Behavioral Disorders, length of stay, chlorpromazine equivalent dose of antipsychotics, locomotive syndrome test scores (25-question GLFS, two-step test, stand-up test), and Barthel Index.

Results: Based on the multivariate logistic regression analysis results, the length of stay and the two-step test score significantly explained the difference between the two groups. The odds ratio of a length of stay greater than 10 years was 8.42 times that of a length of stay less than 2 years (P=0.012, 95% CI=1.59, 44.53). Regarding the twostep test, the odds ratio for obtaining stage 2 was 10.62 times that for obtaining stage 0 (P=0.013, 95% CI=1.65, 68.23).

Conclusion: Those who with longer length of stays and lower two-step test scores tended not to be decided the planned discharge destination.

Key words: Psychiatric long-term care wards, Locomotive syndrome, Length of stay

D einstitutionalization is an ongoing process worldwide for patients with psychiatric disease10). In Japan, the number of psychiatric beds per 100,000 people in 1998 was 287, the highest in the world10. Additionally, the average length of stay (LOS) for the treatment of psychiatric and behavioral impairments in Japan is 277.1 days10. Moreover, long hospitalization in psychiatric long-term care wards is common: 51.1% of inpatients have an LOS exceeding 5 years, and 82.2% have an LOS exceeding 1 year10.

Various studies have examined the factors affecting prolonged LOS among inpatients with psychiatric disease. Longer LOS has been associated with older age, male sex, ethnicity, accommodation and family environment, multiple psychiatric diagnoses, medical-psychiatric comorbidity, and restraints during current admission5-8). In Japanese studies, older age, no use of an ambulance, involuntary admission and lower Global Assessment of Functioning (GAF) scores were identified as factors leading to a longer LOS for inpatients with psychiatric disease5-8). However, few studies have analyzed the relationship between physical

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functioning and LOS.

There have been some reports on the physical functioning of people with psychiatric disease, especially schizophrenia. In patients with schizophrenia, premature aging, weight gain, reduced daily functioning and increased metabolic and cardiovascular risk were reported\(^\text{(11)}\). Low physical fitness in people with schizophrenia was associated with illness duration, smoking, the presence of metabolic syndrome and more severe negative, depressive and cognitive symptoms\(^\text{(12)}\).

In this study, we focused on locomotive syndrome as a low physical function factor that may prevent patients with psychiatric disease from being discharged. Locomotive syndrome occurs in the elderly and describes the condition of those who have come to need nursing care services because of problems with their locomotor appendages or who have risk conditions that may cause them to require such services in the future\(^\text{(13)}\). In some reports on inpatients with psychiatric disease, age was related to prolonged LOS\(^\text{(5,9)}\). Due to the close relationship between age and locomotive syndrome, there may be an association between locomotive syndrome and prolonged LOS, but no studies on this relationship have been performed. Moreover, it was reported that locomotive syndrome is associated with metabolic syndrome\(^\text{(10)}\). Considering the reports that low physical functioning in patients with schizophrenia is associated with metabolic syndrome\(^\text{(11,12)}\), it seems that research focused on locomotive syndrome among patients with psychiatric disease may help explain the factors that prevent them from being discharged.

The purpose of this study is to clarify the factors, including locomotive syndrome, that prevent discharge in psychiatric long-term care wards.

**Method**

**Experimental design**

This was a cross-sectional, multi-institutional study.

**Subjects**

The subjects were 203 patients admitted to psychiatric long-term care wards at three different hospitals in Japan. Individuals were excluded for inability to walk without a cane, failure to provide consent, and missing data. The purpose of this study was to clarify the factors which prevent patients’ discharge destination from deciding even though they were almost independent in their activities of daily living and do not need much physical caregiving. In addition, the two-step test, which was a locomotive syndrome evaluation index, requires a degree of physical function that allows walking without a cane. Therefore, subjects were selected who could walk independently without a cane or any walking aid. Seventy-four subjects were included in the analysis (Figure 1).

The investigation period of this cross-sectional study was from September to December 2018. The study was conducted in accordance with the tenets of the Declaration of Helsinki and was approved by the Ethics Committee of Hirakawa Hospital (approval number: H30-1).

**Outcome**

We asked a nurse or medical social worker in the psychiatric long-term care wards whether the patient’s planned discharge destination had been decided. Planned discharge was defined as discharge to the community, such as to one’s home or a group home, and transfer to other medical facilities was not treated as discharge. Moreover, when the planned discharge destination was not decided, all the items that correspond were chosen from the options prepared beforehand about the reason.

**Explanatory variables**

The subjects’ basic information, namely, age, sex, F code (F0 to F9) in the ICD-10 Classification of Mental and Behavioral Disorders, LOS, and chlorpromazine equivalent dose of antipsychotics (CP dose), was obtained for the analysis. Basic information was obtained from medical records.

To assess the risk of locomotive syndrome, the 25-question Geriatric Locomotive Function Scale (GLFS), a two-step test, and a stand-up test were administered\(^\text{(10)}\). The 25-question GLFS was a self-administered, comprehensive measure consisting of 25 items assessing pain, activities of daily living, social functioning and mental health\(^\text{(10)}\). The 25 items were scored on a five-point scale ranging from 0 (no impairment) to 4 (severe impairment), and the points for each item were then added to calculate the total score (minimum = 0, maximum = 100 points).
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higher the score obtained on the 25-question GLFS, the worse the locomotive function. The validity of this scale and its relationship with disability from locomotive syndrome had been assessed\(^{19}\).

The two-step test measured stride length to assess walking ability, muscle strength, balance, and flexibility of the lower limbs. Subjects started from a standing position and moved two steps forward with the widest stride possible they could manage without losing their balance. If they succeeded in holding the final standing position longer than 3 seconds without any additional steps, the trial was judged as completed. The distance was then standardized by dividing it by the subject’s height. The test was performed twice, and the best result is recorded\(^{18}\).

The stand-up test assessed leg strength by having the subject stood up on one or both legs from a seat of a specified height. Seats of 40 cm, 30 cm, 20 cm and 10 cm were prepared, and the subject stood up from each seat, first with both legs and then with one leg. If the subject could stand up without leaning back to gain momentum and maintain the posture for 3 seconds, then the subject was considered to have passed that height level. In this study, if the subject could stand up with one leg, he or she was given 8 to 5 points; if the subject could stand up with both legs, 4 to 1 points were given. Additionally, with each increment in seat height, 1 point was deducted.

Independence level in activities of daily living (ADL) was evaluated with the Barthel Index. The Barthel Index is an ordinal scale for the functional assessment of disability; its validity and reliability have been verified\(^{11}\), and it has been widely used in neurological and orthopedic disorder outcome research.

**Statistical analysis**

The group whose planned discharge destination was decided was defined as the decided group, and the group whose planned discharge destination was not decided was defined as the undecided group. Subjects’ age, sex, F code, LOS, CP dose, 25-question GLFS score, two-step test score, stand-up test score, and Barthel index were compared between the two groups. In the comparisons of the two groups, the effect size was calculated with the Welch two-sample t-test (Hedges’ g), Fisher’s exact test (or Cramer’s V) and Wilcoxon rank-sum test (Cliff’s Δ).

A multivariate logistic regression analysis was conducted to explain the differences between the decided group and undecided group. Items in which significant differences were found between the groups were treated as explanatory variables. Items treated as explanatory variables were converted to categorical variables with two or three levels. Specifically, age was categorized as elderly people aged 65 years and over and non-elderly people under 65 years; the length of stay was categorized as less than 2 years, 2 years to less than 10 years, and 10 years or more; the two-step test results were categorized as stage 0 (1.3 or more), stage 1 (1.1 or more to less than 1.3), and stage 2 (less than 1.1); and the stand-up test results were categorized as stage 0 (5 points or more), stage 1 (3 points or more to less than 5 points), and stage 2 (less than 3 points). The length of stay was categorized into three periods so that the number of eligible persons would be similar. The categorization of the two-step test and the stand-up test followed the Japanese Orthopaedic Association regulations\(^{20}\).

The goodness of fit of the logistic model was tested with the Hosmer-Lemeshow goodness of fit test. Additionally, to assess how well the model could discriminate between the decided group and the undecided group, receiver operating characteristic (ROC) analysis, the area under the curve (AUC), sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were used.

Regarding the analysis of why the planned discharge destination was not decided, stratified aggregation was performed according to the outcome measures that were confirmed to be significantly different between the decided and the undecided groups.

We conducted all analyses using R version 3.5.1. The threshold for significance was \(p < 0.05\).

**Results**

Table 1 summarizes the comparison of the characteristics between the decided group (\(n=27\)) and the undecided group (\(n=47\)). There were significant differences between the two groups regarding age, LOS, two-step test score and stand-up test score, which were significantly higher in the undecided group than in the decided group (\(p < 0.001\); Hedge’s g=1.08, \(P < 0.001\); Hedge’s g=0.81, \(P < 0.01\); Hedge’s g=0.82, \(P < 0.001\); and Cliff’s Δ=0.45, respectively). There were no significant differences between the two groups in terms of sex, F code, CP dose, 25-question GLFS score and Barthel Index.

Based on the results of the multivariate logistic regression analysis, the LOS and the two-step test score were significant explanatory variables for the difference between the two groups. The odds ratio for an LOS greater than 10 years was 8.42 times that for an LOS less than 2 years (\(P=0.012, 95\% \text{ CI}=1.59, 44.53\)). Regarding the two-step test score, the odds ratio for stage 2 was 10.62 times that of stage 0 (\(P=0.013, 95\% \text{ CI}=1.65, 68.23\)). The P value of the Hosmer-Lemeshow goodness of fit test for the multivariate logistic regression analysis was 0.49 (Table 2).

In the multivariate logistic regression model in which LOS and the two-step test score were set as explanatory variables, the AUC was 0.83 (95% CI: 0.73, 0.92) in the ROC analysis, the sensitivity was 0.81, the specificity was 0.70, the PPV was 82.6%, and the NPV was 67.9%.

The questionnaire results regarding why the planned
Table 1. Comparison of the characteristics of the decided group and the undecided group

|                         | Overall n = 74 | Decided group n = 27 | Undecided group n = 47 | P (ES)          |
|-------------------------|----------------|----------------------|------------------------|----------------|
| Age                     | 58.4 ± 14.0    | 49.7 ± 16.0          | 63.3 ± 9.9             | <0.001         |
| Female, % (n)           | 43.2 (32)      | 31.8 (14)            | 40.9 (18)              | 0.331          |
| F code, % (n)           |                |                      |                        |                |
| F0: 1.4 (1)             |                |                      |                        | 1              |
| F1: 2.7 (2)             |                |                      |                        | 1.08           |
| F2: 83.8 (62)           |                |                      |                        | 0.13           |
| F3: 9.5 (7)             |                |                      |                        |                |
| F4: 0 (0)               |                |                      |                        |                |
| F5: 0 (0)               |                |                      |                        |                |
| F6: 0 (0)               |                |                      |                        |                |
| F7: 2.7 (2)             |                |                      |                        |                |
| F8: 0 (0)               |                |                      |                        |                |
| F9: 0 (0)               |                |                      |                        |                |
| Length of stay (days)   | 3703.6 ± 4240.7| 1636.1 ± 1811.3      | 4891.3 ± 4768.1        | <0.001         |
| CP dose, mg/day         | 492.6 ± 490.9  | 498.1 ± 450.8        | 489.4 ± 517.2          | 0.94           |
| 25-question GLFS, median (1QR, 3QR) | 14.5 (9.0, 27.0) | 13.0 (9.5, 26.0)     | 15.0 (8.0, 27.5)       | 0.59           |
| Two-step test           | 1.0 ± 0.3      | 1.2 ± 0.3            | 1.0 ± 0.3              | 0.003          |
| Stand-up test, median (1QR, 3QR) | 4.0 (3.0, 5.0)  | 5.0 (4.0, 5.0)       | 3.0 (2.5, 4.0)         | <0.001         |
| Barthel Index, median (1QR, 3QR) | 100 (100, 100) | 100 (100, 100)      | 100 (95, 100)          | 0.068          |

DG: Decided group
F0: Mental disorders due to known physiological conditions
F1: Mental and behavioral disorders due to psychoactive substance use
F2: Schizophrenia, schizotypal, delusional, and other non-mood psychotic disorders
F3: Mood [affective] disorders
F4: Anxiety, dissociative, stress-related, somatoform and other nonpsychotic mental disorders
F5: Behavioral syndromes associated with physiological disturbances and physical factors
F6: Disorders of adult personality and behavior
F7: Intellectual disabilities
F8: Pervasive and specific developmental disorders
F9: Behavioral and emotional disorders with onset usually occurring in childhood and adolescence
CP dose: Chlorpromazine equivalent dose of antipsychotics
25-question GLFS: 25-question Geriatric Locomotive Function Scale
a: Welch two-sample t-test, Hedges’ g
b: Fisher’s exact test, φ
c: Fisher’s exact test, Cramer’s V
d: Wilcoxon rank-sum test, Cliff’s Δ

Discussion

In this study, the factors, including locomotive syndrome, preventing discharge from psychiatric long-term discharge destination was undecided for those in the undecided group are presented in Table 3. The reasons were as follows: a long hospitalization and consequently poor life skills (n=39, 83.0%), few institutions in the community receiving patients with psychiatric disease (n=35, 74.5%), and patient’s family would not accept discharge (n=33, 70.2%). Strong psychiatric symptoms requiring hospitalization (n=5, 10.6%) and refusal of discharge by the patient him/herself (n=2, 4.3%) were also factors.
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The comparison between the decided group and undecided group revealed that those in the undecided group were older and had a longer LOS, worse two-step test scores and worse stand-up test scores (Table 1). The age results were consistent with previous studies\(^5,9\), and the reason for this finding was likely because the number of comorbid diseases other than psychiatric disorders increases with age. The LOS of the undecided group was longer. Previous Japanese research reported that the most common discharge destination for patients hospitalized in a psychiatric ward for one year or longer was a psychiatric ward in another hospital (47.4%)\(^21\). It has become clear that it is difficult to discharge patients who have experienced long-term hospitalization to the community.

There were significant differences between the two groups with respect to the two-step test and stand-up test scores; therefore, a slight decline in physical functioning, even if activities of daily living can still be performed without assistance, might have a negative effect on the discharge destination decision. It has been reported that activity limitations associated with locomotive syndrome may appear in the following order: sports activity, walking, transferring, and self-care\(^22\). Therefore, patients in this study may have experienced decreased physical functioning that has affected their social life, such as their ability to do housework and socialize. There was no significant difference in the 25-question GLFS score between the two groups, although there were significant differences in the two-step test and stand-up test scores. It was inferred that some patients with psychiatric disease overestimated or underestimated their own health status and did not present corresponding results on the two-step test or the stand-up test. Regarding the F code, F2 (schizophrenia, schizotypal, delusional, and other non-mood psychotic disorders) was the most common in both groups, and there was no difference between the groups. In this study, CP dose was not related to the discharge destination decision, although tardive

| Table 2. Multivariate logistic regression analysis of factors that explain the difference between the decided group and the undecided group |
|-------------------------------------------------|
| Overall n = 74 | Decided group n = 27 | Undecided group n = 47 | Crude OR (95% CI) | P | Adjusted OR (95% CI) |
| Age |
| <65 years | 44 | 19 | 25 | 1 | (Reference) | (Reference) |
|          | (59.5) | (70.4) | (53.2) | 2.09 | 0.539 | 0.65 |
| ≥65 years | 30 | 8 | 22 | 1.30 | 0.619 | 1.41 |
|          | (40.5) | (29.6) | (46.8) | (0.76, 5.71) | (0.16, 2.6) |
| Length of stay |
| <2 years | 22 | 12 | 10 | 1 | (Reference) | (Reference) |
|          | (29.7) | (44.4) | (21.3) | (Reference) | (Reference) |
| ≥2 years, <10 years | 25 | 12 | 13 | 1.30 | 0.619 | 1.41 |
|          | (33.8) | (44.4) | (27.7) | (0.41, 4.1) | (0.37, 5.38) |
| ≥10 years | 27 | 3 | 24 | 9.6 | 0.012 | 8.42 |
|          | (36.5) | (11.2) | (51.0) | (2.22, 41.52) | (1.59, 44.53) |
| Two-step test |
| Stage 0; | 13 | 9 | 4 | 1 | (Reference) | (Reference) |
|          | (17.6) | (33.3) | (8.5) | (Reference) | (Reference) |
| Stage 1; | 19 | 11 | 8 | 1.64 | 0.47 | 1.92 |
|          | (25.7) | (40.7) | (17.0) | (0.37, 7.25) | (0.33, 11.36) |
| Stage 2; | 42 | 7 | 35 | 11.25 | 0.013 | 10.62 |
| <1.1 | (56.7) | (26.0) | (74.5) | (2.69, 47.02) | (1.65, 68.23) |
| Stand-up test |
| Stage 0; | 23 | 14 | 9 | 1 | (Reference) | (Reference) |
|          | (31.1) | (51.9) | (19.1) | (Reference) | (Reference) |
| Stage 1; | 37 | 11 | 26 | 3.68 | 0.785 | 1.22 |
|          | (50.0) | (40.7) | (55.3) | (1.23, 10.99) | (0.29, 5.21) |
| Stage 2; | 14 | 2 | 12 | 9.33 | 0.165 | 4.21 |
| <3 points | (18.9) | (7.4) | (25.6) | (1.68, 51.88) | (0.55, 32.09) |

P value of Hosmer-Lemeshow goodness-of-fit test: 0.49
dyskinesia associated with antipsychotic treatment is known to affect lower-body physical functioning in patients with schizophrenia. The Barthel Index was perfect for many patients and showed the ceiling effect of the evaluation; thus, there was no difference between the two groups.

In the multivariate logistic regression analysis, the LOS and two-step test score were adopted as significant explanatory factors regarding whether or not the planned discharge destination was decided. A total of 74.5% of the patients in the undecided group had stage 2 locomotive syndrome according to the two-step test. In contrast, 25.6% of the patients in the undecided group had stage 2 locomotive syndrome according to the stand-up test. In a previous study, it was reported that the two-step test is more likely to show a worse outcome than the stand-up test. In this study, the two-step test was also better able to detect a slight decrease in physical functioning than the stand-up test, and it was assumed that the two-step test score was a factor that explained the planned discharge destination. Stage 2 locomotive syndrome is diagnosed as progressing to a decline in mobility. It was speculated that this decline in mobility was interpreted as possible limitations in instrumental activities of daily living, such as shopping and using public transportation, which would not have enabled a decision regarding discharge destination. This suggests that the two-step test may be able to evaluate the decline in mobility that does not appear in the Barthel Index. In general, it is known that the more advanced a person’s age is, the lower his or her physical functioning is. In this study, age was not considered, but the two-step test score was adopted as a factor explaining whether or not the planned discharge destination was decided. Regarding the reason for this result, it was reported that decreased mobility among elderly adults

### Table 3. Number of respondents who gave positive responses to the items regarding why planned discharge destination was undecided

| Questions                          | Positive response (n=47) | Age <65 years (n=25) | Length of stay <2 years (n=10) | Two-step test Stage 0 (n=4) | Stand-up test Stage 0 (n=9) |
|------------------------------------|-------------------------|----------------------|-------------------------------|---------------------------|-----------------------------|
| Long hospitalization               | 39 (83.0)               | 20 (80.0)            | 5 (50.0)                      | 2 (50.0)                  | 6 (66.7)                    |
|                                    |                         | 19 (76.0)            | 12 (92.3)                     | 7 (87.5)                  | 23 (88.5)                   |
|                                    |                         | 22 (91.7)            | 30 (85.7)                     | 30 (85.7)                 | 10 (83.3)                   |
| Few receiving institutions         | 35 (74.5)               | 16 (64.0)            | 7 (70.0)                      | 1 (25.0)                  | 5 (55.6)                    |
|                                    |                         | 19 (86.4)            | 9 (69.2)                      | 6 (75.0)                  | 22 (84.6)                   |
|                                    |                         | 19 (79.2)            | 28 (80.0)                     | 6 (75.0)                  | 22 (84.6)                   |
|                                    |                         |                      |                               |                           |                             |
| Family acceptance                  | 33 (70.2)               | 17 (68.0)            | 7 (70.0)                      | 1 (25.0)                  | 3 (33.3)                    |
|                                    |                         | 16 (72.7)            | 9 (69.2)                      | 6 (75.0)                  | 22 (84.6)                   |
|                                    |                         |                      |                               |                           |                             |
| Psychiatric symptoms               | 28 (59.6)               | 15 (60.0)            | 8 (80.0)                      | 1 (25.0)                  | 7 (77.8)                    |
|                                    |                         | 13 (59.1)            | 8 (61.5)                      | 4 (50.0)                  | 13 (50.0)                   |
|                                    |                         |                      |                               |                           |                             |
| Physical disability                | 5 (10.6)                | 3 (12.0)             | 0 (0.0)                       | 1 (25.0)                  | 0 (0.0)                     |
|                                    |                         | 2 (9.1)              | 1 (7.7)                       | 0 (0.0)                   | 2 (7.7)                     |
|                                    |                         |                      |                               |                           |                             |
| Patient refusal                    | 2 (4.3)                 | 0 (0.0)              | 0 (0.0)                       | 0 (0.0)                   | 0 (0.0)                     |
|                                    |                         | 2 (9.1)              | 0 (0.0)                       | 0 (0.0)                   | 2 (7.7)                     |
|                                    |                         |                      |                               |                           |                             |

Long hospitalization: Long hospitalization, and consequently, poor life skills.
Few receiving institutions: There are few institutions in the community for receiving patients with psychiatric disease.
Family acceptance: Family does not accept discharge.
Psychiatric symptoms: Psychiatric symptoms are severe, and hospitalization is required.
Physical disability: Persistent physical disability is present.
Patient refusal: The patient refuses to be discharged.

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with a disability is unrelated to age\textsuperscript{20}; therefore, the mobility issues may have been influenced by medical-psychiatric comorbidity in this study. The questionnaire results regarding why the discharge destination was not decided showed that the difference between the groups according to age was not as great as the difference according to the two-step test or stand-up test stage. In physical therapy, it seemed necessary to conduct a screening assessment for locomotive syndrome with the two-step test to detect early decline in motor performance and to implement interventions to prevent the severity of the disorder.

In the stratified aggregation results regarding why the planned discharge destination was undecided, for the majority of patients who were evaluated as having stage 2 locomotive syndrome according to the two-step test, the reason was not physical disability (4 of 35 patients; 11.4%). Indeed, many of the patients who were classified as having stage 1 or 2 locomotive syndrome according to the two-step test were in the undecided group because of an insufficient number of receiving institutions or family refusal. Considering these results, it is suggested that nurses or medical social workers may have recognized slight declines in physical functioning, such as locomotive syndrome, and used this observation as a reference for discharge planning.

One limitation of this study was that it did not examine planned discharge destination decisions from a longitudinal perspective. This was a cross-sectional study of the factors that may explain the planned discharge destination decision; thus, it was not evident whether these explanatory factors impact the actual discharge. In the questionnaire survey, the nurses and social workers indicated that the discharge destination was undecided for 59.6% of patients due to psychiatric symptoms; however, we did not investigate the presence or extent of positive and negative symptoms of psychiatric disease. This is also a limitation of this study. Despite these limitations, this study suggests that locomotive syndrome may affect hospital discharge; thus, further research is needed.

**Conclusion**

The present study identified the factors affecting the planned discharge destination. It was found that a longer LOS and a lower two-step test score inhibited decisions regarding planned discharge destination.

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