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Cognitive deterioration upon admission is an important risk indicator of falls in the respiratory ward

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Abstract

Objective: Falls have become a major problem in hospitalized elderly patients. During the hospitalization, a nurse evaluates the risk of falls using a fall assessment sheet. However, this assessment sheet does not reflect the characteristics of each ward or disease. Therefore, this study aimed to clarify the characteristics of falls in respiratory wards.

Methods: Medical records of patients admitted to our respiratory ward from April 1, 2018, to March 31, 2019, were reviewed. Patients were divided into fall (N=18) and non-fall (N=343) groups, and their clinical test results, A fall assessment sheets, and Functional Independence Measure (FIM) scores were examined.

Results: Scores on the admission a fall assessment sheets were poorer, and the item of cognitive ability was lower in the fall than that in the non-fall group (p=0.008). With regard to FIM, no significant difference was found in the FIM motor score, but the FIM cognitive score was significantly lower in the fall group. The FIM motor score was significantly improved after hospitalization, but the FIM cognitive score did not improve. The difference in disease, Alb, Hb, and body mass index (BMI) was not significant.

Conclusion: The risk of falls in respiratory wards is high. In particular, cognitive deterioration upon admission was the most common cause of falls in respiratory wards.

Introduction

Japan has become a super-aging society, and the proportion of elderly inpatients is continuously increasing. As a result, falls are the most common type of medical accident, and its incidence is increasing each year [1]. Prevention of falls is an important issue for medical safety because falls not only require new treatment but also lengthen hospital stays and increase medical expenses [2].

Effective intervention to prevent falls involves screening for falls and preselecting high-risk patients upon admission. The usefulness of a fall risk assessment tool has been suggested and is used in several facilities in japan.

However, this tool has not been adapted according to the specific characteristics of each ward, although many studies have been made on falls in chronic disease wards and in patients with cerebral infarction. In addition, no fall risk assessment tool to predict falls in hospitalized patients from each department has been statistically verified to predict the accuracy, suggesting that patients at risk of falls may not be accurately grasped. As the cause of falls differs in each ward, dealing with each department is desirable. The fall rate in respiratory wards is known to be high [3,4], but the cause remains unclear. Therefore, this study aimed to analyse the risk of falls in respiratory wards.

Patients and methods

This study examined 361 patients (including multiple hospitalizations) who were admitted to our hospital's respiratory ward for at least one week from April 1, 2018, to March 31, 2019. Patients in other departments and with insufficient data were excluded.

The survey items were as follows: falls, age at admission, gender, main illness, complications, devices (oxygen administration, infusion, thoracic drain tube, tracheal cannula), body mass index (BMI), hemoglobin (Hb), Alb, fall assessment sheet score upon admission, presence of rehabilitation, discharge destination, and Functional Independence Measure (FIM). However, FIM was measured only in rehabilitation patients (N=216).

FIM was performed using a 7-point scale, with 13 items on motor subscale and 5 items on cognition subscale for daily life activity independence. The FIM is one of the most commonly used in rehabilitation programmes in japan. The FIM total score (T-FIM), the FIM motor score (M-FIM), and FIM cognitive score (C-FIM) were compared a fall group to a non-fall group. This measurement was performed by a physiotherapist/occupational therapist after admission and immediately before discharge. Patients were divided into a fall group (N=18) who fell and a non-fall group (N=343) who did not fall. Pearson's X^2 test and Mann–Whitney U-test were performed to determine the occurrence of falls.

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The study was approved by the Research Ethics Committee of Kanazawa Medical University (Protocol: No. I511).

Results

Total fall rates in our wards were 1.80 falls per 1,000 patient days. In the fall group, the length of hospital stays, the number of rehabilitation introductions, and the fall assessment sheet score were significantly high, but the difference in BMI, Alb, and Hb was not significant (Table 1 and 1 A).

Table 2 shows the examination results of the main diseases and the environment. Lung cancer was the most common in-patient disease, followed by community-acquired pneumonia and aspiration pneumonia. No between-group differences were observed based on disease variability. Majority of lung cancers were advanced stage, and 42 patients had brain metastases. Best supportive care comprises 34% of treatment strategies. No significant differences were found in the following comorbidities: cerebrovascular disease, neurological disease, epilepsy, dementia, and mental illness. The turning point was that the hospital was frequently transferred in the fall group. As regards the environmental factors, 94% of patients received intravenous infusions, and all patients who fell down received infusions. The fall group had no thoracic drain tube and tracheal cannula inserted.

The fall assessment sheet score is divided into a low-risk group, (0–5 points), medium-risk group (6–10 points), and high-risk group (11–16 points), with fall rates of 1.9%, 3.4%, and 9.4%, respectively. The fall score was significantly higher in the fall group than that in the non-fall group (Table1 and 1A), and the difference in the distribution according to the risk level was found. In the examination according to each item, only the cognitive ability was significantly lower in the fall that that in the non-fall group (Table1), whereas other items showed no significant differences (Table 3).

Except for patients who underwent rehabilitation intervention, FIM-based studies showed that no difference was found M-FIM upon admission. Only C-FIM was significantly lower in the fall group with a significant difference (Table 4). On discharge, exercise improvement was observed. When comparing before and after hospitalization results, improvement in C-FIM was poor. M-FIM improvement was also poor in the fall group (Table 5).

Table 1. A Fall assessment sheet checklist at our hospital: If any one of the items from A to G is applicable, enter the reference point. The risk of falling is assessed on a 16-point scale. 0–5 points are considered as low risk, 6–10 points are intermediate risk, and 11–16 points are high risk

Item		Checklist		Reference point
A	Age	☐ 70 years old or older ☐ 9 years old or younger		2
B	Medical history	☐ History of falls ☐ History of loss of consciousness		1
C	Sensation	☐ Has a hearing impairment ☐ Has vision impairment ☐ Has visual field damage		1
D	Range of activity	☐ Has paralysis or numbness ☐ Has contractures/deformities in their extremities ☐ Has missing extremities ☐ Has poor balance ☐ Has weak feet/lower back ☐ Has abnormal gait ☐ Uses a wheelchair/walker/cane ☐ Requires assistance when moving around		4
E	Cognitive ability	☐ Has delirium and shows menacing behavior ☐ Shows menacing behavior ☐ Has impaired memory ☐ Shows impaired judgment ☐ Shows a decline in the ability to understand		3
F	Pharmacotherapies	☐ Sleep stabilizers ☐Narcotics ☐Antihypertensive diuretics ☐ Anti-Parkinson agents	☐ Sedatives ☐ Chemotherapy ☐ Enema/laxatives ☐ Anti-dementia agents	2
G	Excretion	☐ Has urinary incontinence ☐ Has fecal incontinence ☐ Always has an urge to urinate ☐ Always has an urge to defecate ☐ Requires assistance to go to the bathroom ☐ Goes to the bathroom at night ☐ Uses a portable toilet		3

Table 1A. Distribution table for the fall and non-fall groups at the time of admission.

	Fall group		Non-fall group		p value
Number of times	**18 number (Fell twice: 2 number)**		**343 number**		
Age	75.06		71.92		0.1240†
Male: female ratio, male (%)	12: 6	(66.7 %)	230: 113	(67.0 %)	0.9727*
Duration of hospitalization	43.61		26.92		0.0005†
Rehabilitation intervention	13件	(72.2 %)	203件	(59.2 %)	0.2714*
Fall score ‡	10.72		7.97		0.0041†
BMI (kg/m^2)	21.79		21.80		0.6901†
Alb (mg/L)	3.36		3.45		0.5212†
Hb (g/dL)	11.12		12.21		0.1569†

* : χ2 test; † : Mann-Whitney U test; ‡: Fall score: Total score of the fall assessment sheet.

Table 2. Characteristics of hospitalization. A: Table of primary underlying diseases at the time of admission. Other includes mycobacterium avium complex (MAC), pulmonary arteriovenous fistulas, pneumocystis pneumonia, IgG-related disease (IgG-RD), and sarcoidosis. B: Lung cancer stage and treatment strategy. C: Evaluation of the presence/absence of patient devices such as oxygen during hospitalization, comorbidities at the time of admission, and discharge destination. §: One patient with Parkinson's disease, one patient with spinocerebellar degeneration and one patient with hydrocephalus. Evaluated using Pearson's $\chi 2$ test. *: $p<0.01$.

A

Primary underlying disease	Total N=361	Fall group N=18	Non-fall group N=343
Lung cancer	152	6	146
Community-acquired pneumonia	50	0	50
Aspiration pneumonia	48	7	41
Interstitial pneumonia	43	3	40
Empyema	5	0	5
Pneumothorax	4	0	4
chronic obstructive pulmonary disorder (COPD) acute exacerbation	18	0	18
Asthmatic attack	10	0	10
Other	31	2	29

B

	Total N=361	Fall group N=18	Non-fall group N=343
Stage I-II	8	0	8
Stage III	42	1	41
Stage IV	103	5	97
Brain metastases present	42	2	40
Treatment strategy			
Treatment/testing	101	3	98
Palliative care	51	3	48

C

	Total N=361	Fall group N=18	Non-fall group N=343
Comorbidities (multiple conditions in the same patient present)			
Cerebral infarction/cerebral hemorrhage	27	4	23
Neurological disorder [§]	3	0	3
Dementia	16	3	13
Epilepsy	8	2	6
Mental illness	17	0	17
Discharge destination			
Discharged home	276	8	268[*]
Transfer to a different institution/Hospice care	64	9	55[*]
Transfer to a different department	3	0	3
Death	36	1	35
Environment			
Oxygenation	139	9	130
Drain placement	14	0	14
Presence or absence of tracheostomy	6	0	6
Infusion	340	18	322
None of the above	16	0	16

Table 3. Comparison of a fall assessment sheet scores at the time of admission

		Fall group N=18	Non-fall group N=343	p value
Overall score		10.72 ± 3.84	7.97 ± 3.75	0.0041[†]
A	Age	14	229	0.1949*
B	Prior medical history	8	97	0.0844*
C	Sensation	9	121	0.1286*
D	Range of activity	14	214	0.1013*
E	Cognitive ability	7	47	0.0008*
F	Pharmacotherapies	10	163	0.3629*
G	Excretion	17	311	0.2959*

*: $\chi 2$ test; †: Mann–Whitney U test

Table 4. 4A: Comparison of M-FIM score at the time of admission. Low M-FIM score at admission: 13–39 points, intermediate score: 40–78 points, high score: 79–91 points. 4B: Comparison of C-FIM score at the time of admission. Low C-FIM score at admission: 5–25 points, high score: 26–35 points. Evaluations were performed using Pearson's $\chi 2$ test. 4C: Comparison of FIM scores at the time of admission and discharge. Evaluated using Mann-Whitney U test.

A

M-FIM score at admission	Fall group	Non-fall group
Low score	4	52
Intermediate score	7	91
High score	2	57

B

C-FIM score at admission	Fall group	Non-fall group
Low score	6	22
High score	7	179

C

	Fall group (Mean)	Non-fall group (Mean)	p value
M-FIM score at admission	48.15	57.85	0.0618
C-FIM score at admission	27.08	32.29	0.0124
M-FIM score at discharge	62.50	74.21	0.0254
C-FIM score at discharge	25.17	32.58	0.0005

Table 5. Changes in FIM score after hospitalization and before discharge in rehabilitated patients. Evaluated using Paired T test.

	After hospitalization (Mean)	Before discharge (Mean)	p value
T-FIM			
Total	79.32	100.25	< 0.0001
Fall group	75.23	87.58	0.1561
Non-fall group	82.73	102.74	< 0.0001
M-FIM			
Total	57.26	68.98	< 0.0001
Fall group	48.15	62.50	0.1172
Non-fall group	57.85	74.21	< 0.0001
C-FIM			
Total	31.98	32.03	0.8967
Fall group	27.08	25.17	0.1752
Non-fall group	32.29	32.58	0.6361
Non-fall group	79.32	100.25	< 0.0001

Discussion

In recent years, inpatients have become increasingly aging in Japan. In this study, 85% of inpatients are elderly people aged ≥ 65 years, and the number of inpatients highly at high for falling is increasing [4].

As measures to prevent falls at our hospital, nurses evaluate the fall risk of patients using a fall assessment sheet in Japan, whereas the fall risk assessment of patients under rehabilitation intervention is performed in the rehabilitation department using FIM. If the risk of falling is over the intermediate risk, information is shared at the conference and measures are taken to improve the breathing state and device arrangement. When falls occur, medical professionals submit an incident report and future countermeasures should be considered. The fall rate in acute care hospitals varies among different reports but been reported from 1.38 to 4.3 % falls per 1,000 patient days [3,5,6].

Sato et al. reported that the fall rate in respiratory medicine and rheumatology wards was higher than the overall fall rate [6]. However, in our ward, the fall rate was 1.80 % falls per 1,000 patient days, and our measures were considered effective.

In this study, a difference was found only in the length of hospital stay and the place of discharge according to the patient background. Dunne et al. reported that falls in acute care hospitals make discharges 2.4 times more difficult [7]. In this study, no differences were found in terminal patients, background disease/blood data, comorbidities, and motor function. Patients were considered difficult to discharge to their respective homes and had prolonged hospital stay because of the fall. Motor function improvement in the fall group is poor even under rehabilitation intervention and is important to prevent falls (Table 5).

In japan, the fall assessment sheet is commonly used, and results of this study also showed a significant difference between the fall and non-fall groups. With this, the risk for falls can be sufficiently evaluated even in the respiratory ward. However, when comparing the items in detail, only the difference in cognitive dysfunction was significant based on the results in the fall group, which was the same as in FIM. The cognitive function deterioration could lead to falls due to misjudgement [8].

In addition, environmental characteristics in the respiratory ward include several devices connected to the oxygen tube, the infusion line, and the patient. In this study, 94% of inpatients were treated with intravenous therapy, and approximately half of them received nasal or mask oxygen. Patients receiving oxygen are reported to be at increased risk of falling [9]. In an environment where the risk of falls is high, lack of cognitive ability to grasp changes in the surrounding environment and physical changes seem to have been the most important factors that cause falls.

In addition, as shown in Table 5, improvement of exercise items can be expected by improving the general condition and rehabilitation

accompanying disease remission; however, cognitive function improvement is poor. This suggests that cognition function evaluation upon admission is important to assess the risk for falls in the future.

Limitations

The limitations of this study are as follows: the analysis period is only 1 year and further accumulation of the number of falls is necessary. In this study, the evaluation was limited to simple items such as assessment sheets, and therefore, examinations using cognitive function tests such as Hasegawa's formula should have also been used. In addition, FIM was measured only for rehabilitation-introduced patients. However, a bias often occurs in patients undergoing rehabilitation because they are often introduced in patients with reduced ADL. In addition, fall assessment and FIM tend to be similar, and we analysed them to be reliable in this study. All cases should be investigated in the future. A fall assessment sheet specifically made for respiratory wards should also be considered with emphasis on cognitive skills.

Conclusion

During respiratory hospitalization, patients used many devices, making them highly at risk of falling. As the value of the fall assessment sheet (FIM) decreases, the fall rate increases. In addition, cognitive deterioration during hospitalization is the most important cause of falls, and therefore, these patients need further measures to prevent falls.

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