

Validity of a fall risk assessment score sheet for patients hospitalized in general wards

Tetsuo Hagino¹, Satoshi Ochiai¹, Shinya Senga¹, Takashi Yamashita¹, Masanori Saito¹, Masanori Wako², Naofumi Taniguchi², Takashi Ando² and Hirotaka Haro²

¹*Department of Orthopaedic Surgery, National Hospital Organization Kofu National Hospital, Kofu, Japan*
²*Department of Orthopaedic Surgery, Faculty of Medicine, University of Yamanashi, Chuo, Japan*

ABSTRACT

Falls (including fall on same level and fall to a lower level) are frequent medical accidents among hospitalized patients. We investigated the status of falls in our hospital, aiming to verify the usefulness of a fall risk assessment sheet and identify the risk factors of falls. 5219 patients who were admitted to the general wards of our hospital between April 2016 and March 2019 were studied. Patient background data and the result of risk assessment based on a fall risk assessment score sheet at admission were registered. The frequency and location of falls during hospitalization, and the impact on patients were investigated. Risk factors for falls were analyzed based on the assessment results at admission. 218 falls occurred during hospitalization in 152 of 5219 patients (2.9%). The most common location of falls was bedside (68%). Falls occurred at night in 28%. The impact of falls was level I in 18 patients, level 2 in 117, level 3a in 11, and level 3b in 6 (all had head injuries, and one had concurrent fracture). Fall rate was 1.1% (41/3791 patients) at risk level I, 6.8% (91/1335 patients) at level II, and 21.5% (20/93 patients) at level III. Multiple logistic regression analysis identified age, history of fall, tendency to act without pressing nurse call button, unstable gait, unstable when standing, and use of narcotic as risk factors of falls. The incidence of falls at our hospital was lower compared to previous reports, and fall risk assessment was useful overall.

Keywords: Falls, risk assessment, risk factor

Abbreviations:

Falls: including fall on same level and fall to a lower level

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INTRODUCTION

Japan has become a super-aging society, and the proportion of older hospitalized patients is increasing accordingly. In addition, falls (including fall on the same level and fall to lower level,

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Corresponding Author: Tetsuo Hagino, MD, PhD

Department of Orthopaedic Surgery, National Hospital Organization Kofu National Hospital, 11-35 Tenjin-cho, Kofu 400-8533, Japan

Tel: +81-55-253-6131, Fax: +81-55-251-5597, E-mail: hagino.tetsuo.se@mail.hosp.go.jp

the same applies hereinafter) are frequent medical accidents among hospitalized patients, and the incidence continues to increase every year.¹ In particular, serious traumatic injuries including fractures and head injuries pose serious problems such as prolonged hospital stay, impaired ADL, impact on survival, and may even develop into medical disputes.² In fall prevention measures in hospitals and other facilities, early identification of patients at high risk of falling is most important. The fall assessment tools used in Japan attempt to capture a wide range of fall risks and evaluate them in detail. Consequently, detailed score sheets that incorporate a large number of items are widely used. However, these tools contain some items that lack clear evidence of usefulness and some that are difficult to evaluate objectively.³ In Europe and America, simple assessment tools have already been developed.^{4,5} We aimed to develop a simple in-patient assessment tool that can predict falls during hospitalization and is suitable for use in general hospitals in the community. Using the fall risk assessment score sheet that we developed, we investigated the status of falls in our hospital, and evaluated the usefulness of fall assessment at the time of admission.

SUBJECTS AND METHODS

Our hospital is a regional core hospital having a ward for patients with severe motor and intellectual disabilities, a pediatric and perinatal care ward, and an acute phase general ward, with a total of 276 beds. The characteristic of our hospital is that the 100 beds in the general ward are occupied by a large proportion of orthopedic patients. All 5219 patients admitted to general wards of our hospital between April 2016 and March 2019 were studied. The subjects were aged 56.0 ± 25.4 (range 5–105) years, and composed of 2486 males (47.6%) and 2733 females (52.4%). The departments in which the patients were hospitalized were orthopedic surgery in 3419 patients (66%), gastrointestinal surgery in 981 patients (19%), internal medicine in 421 patients (8%), ophthalmology in 328 patients (6%), and others in 70 patients (1%). Patient background data and the results of risk assessment based on a fall risk assessment score sheet surveyed at the time of admission were registered. The fall risk assessment score sheet was constructed with reference to the National Hospital Organization Approach to Safety in Medical Care [White Paper on Medical Safety], 2010 edition. During hospitalization, the frequency of falls, the location, and the degree of impact on the patients were investigated prospectively. Data of the occurrence of falls and the details were collected from all the incident reports submitted by nurses and other hospital staff members. Based on the above data, the relationship between the risk assessment result and the incidence of falls was analyzed. The risk level was determined at admission using a fall risk assessment score sheet. (Table 1), by which patients were scored for age, history of falls, environmental change, personality, physical function, cognitive function, activity status, and drug use. Risk level was graded from level I to III based on the scores obtained. Furthermore, the risk factors for falls were identified by analyzing the results of risk assessment at admission.

Table 1 Fall Assessment Score Sheet

| | | Fall assessment score | At admission | |
|--|---|---|---|--------------------------|
| Patient characteristics | Age | 70 years or above | <input type="checkbox"/> | |
| | Past history | Had fall during previous hospitalization, or within the last three months | <input type="checkbox"/> | |
| | Environmental change | 1 | Is in a period of rapid recovery or worsening of condition or ADL (including surgery) | <input type="checkbox"/> |
| | | 2 | Less than 7 days after admission or change of ward or room (for those aged 65 or above) | <input type="checkbox"/> |
| | | 3 | Is in a period of starting rehabilitation or undergoing training | <input type="checkbox"/> |
| Personality | Tends to act without pressing nurse call button | <input type="checkbox"/> | | |
| Patient condition | Physical condition | 1 | Leg strength and muscles are weakened | <input type="checkbox"/> |
| | | 2 | Can walk independently, but gait is unstable | <input type="checkbox"/> |
| | | 3 | Unstable when standing without support | <input type="checkbox"/> |
| | | 4 | Is bedridden, but can move the body in bed | <input type="checkbox"/> |
| | Cognitive function | Memory and judgment are impaired | <input type="checkbox"/> | |
| Activity state | 1 | Is using a wheelchair, walker or handrail | <input type="checkbox"/> | |
| | 2 | Needs assistance with mobility and excretion | <input type="checkbox"/> | |
| Drug use | 1 | Is using sleeping medication | <input type="checkbox"/> | |
| | 2 | Is using anti-parkinsonian drug or muscle relaxant | <input type="checkbox"/> | |
| | 3 | Is using narcotic | <input type="checkbox"/> | |
| Number of items checked (score 1 point for 1 item) / risk level | | | / | |

Risk level I: score 0 to 3

Risk level II: score 4 to 9

Risk level III: score 10 or above

For statistical analyses, χ^2 test was used in univariate analysis, and multiple logistic regression analysis was used in multivariate analysis. The significance level was set at less than 5% in both analyses. StatFlex ver. 7 was used in statistical analyses.

The study was approved by the Ethical Committee of the National Kofu Hospital.

RESULTS

A total of 218 falls occurred during hospitalization in 152 of 5219 patients (3%). The fall rate [(number of falls) / (number of all hospitalized patient-days) × 1,000] was 2.45 falls per 1,000 patient-days. Of the 152 patients, 115 had only one fall, while 37 had repeated falls (4 patients had 4 falls, 3 patients had 5 falls, and 1 patient had 7 falls) (Figure 1). When we compared 115 patients who fell only once and 37 patients who had multiple falls, cross-tabulation of all items in the fall risk assessment score sheet at the time of admission revealed significant differences between the two groups in 3 items: (1) less than 7 days after admission ($p = 0.0041$), (2) leg strength and muscles are weakened ($p = 0.0099$), and (3) can walk independently, but gait is unstable ($p = 0.0254$).

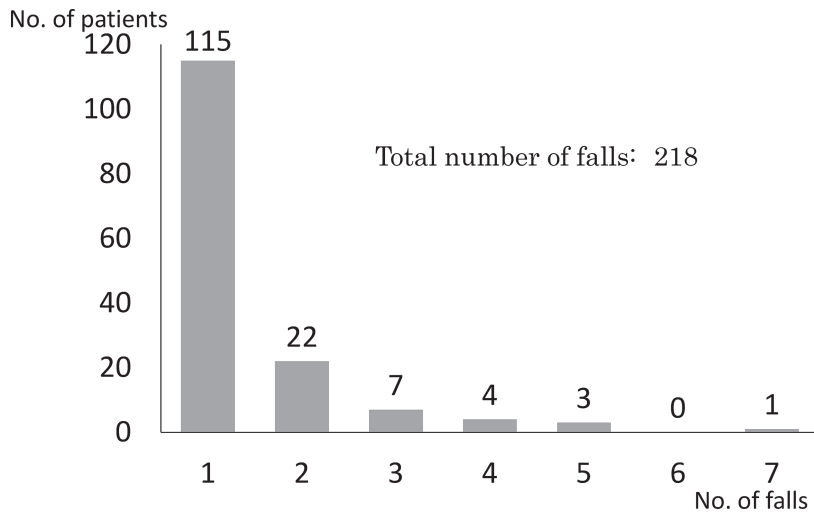


Fig. 1 Number of falls

A total of 218 falls occurred in 152 patients; 115 patients had only 1 fall and 37 patients have repeated falls.

The most frequent location of falls was bedside with 149 falls (68%), followed by toilet with 19 falls (9%), patient room, and corridor (Figure 2). Falls occurred not only during daytime, but many also occurred during nighttime (Figure 3). Furthermore, when divided by time zone of occurrence, 71 falls (51.1%) occurred from 8:00 to 20:00 and 68 falls (48.9%) occurred at night from 20:00 to 8:00, showing that approximately one-half of the falls occurred during nighttime. Considering the small number of people active at night, the rate of nighttime falls was high. Regarding age distribution, falls occurred more frequently in older patients aged 65 years and above (Figure 4).

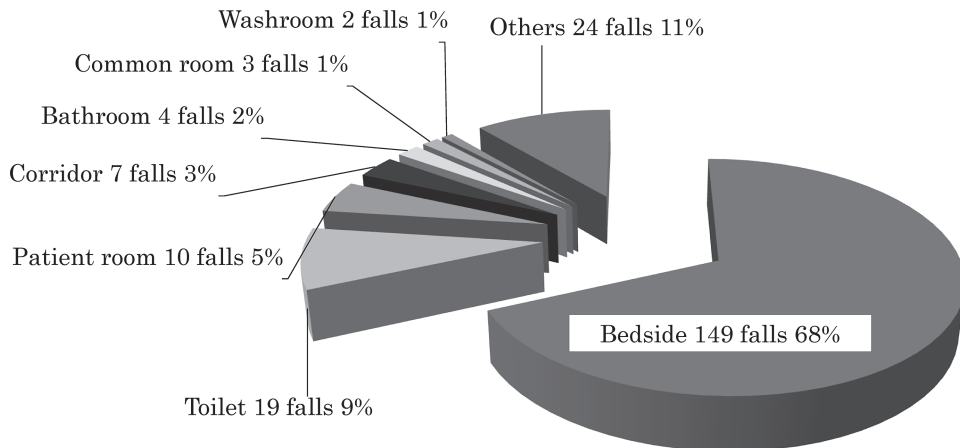


Fig. 2 Locations where falls occurred

Validity of a fall risk assessment

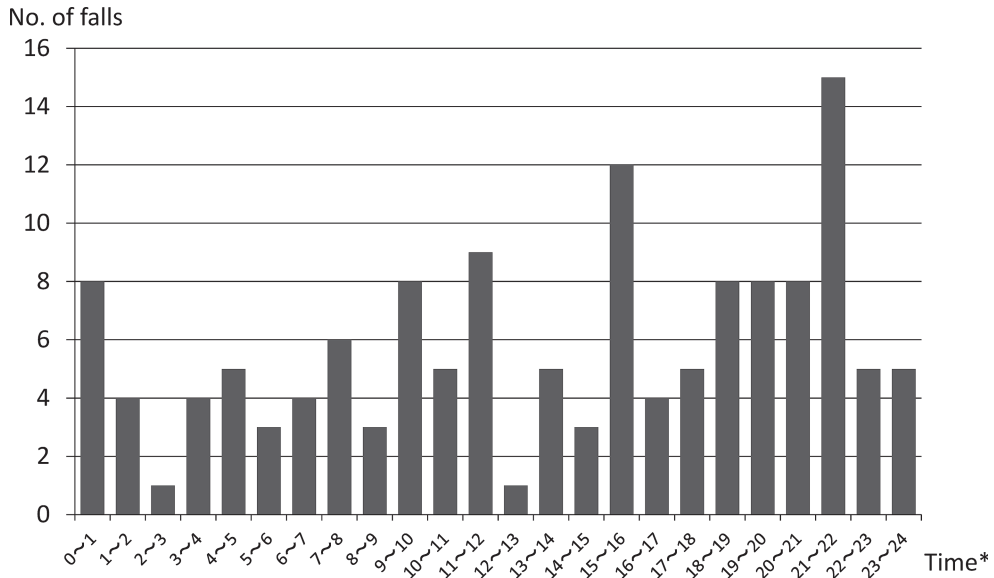


Fig. 3 Time when falls occurred

*Time of fall 0~1: falls occurring from 0:00 to 1:00 (13 falls with unknown time of occurrence were excluded).

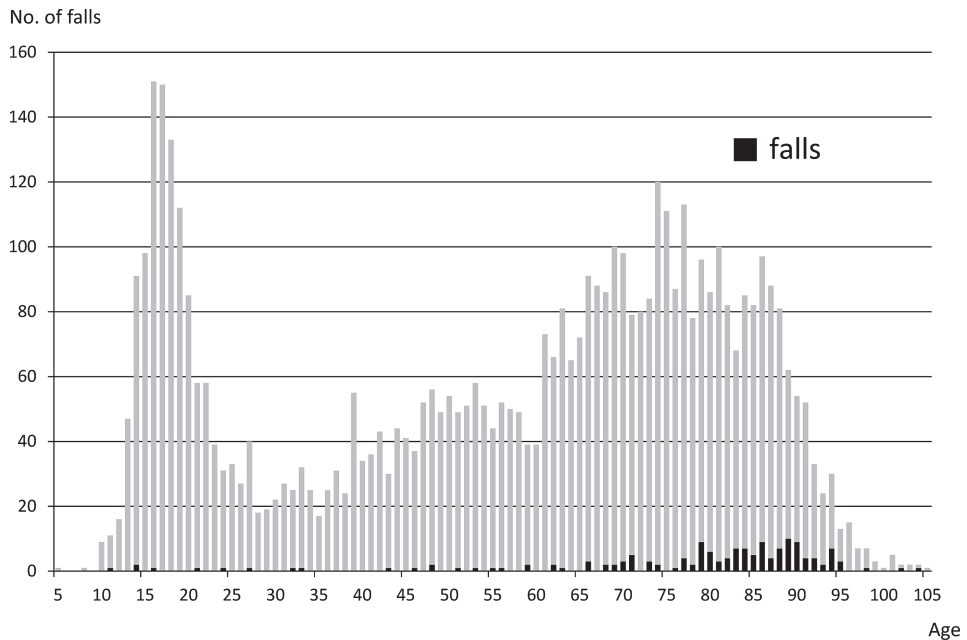


Fig. 4 Age distribution of patients with falls

The impact of falls on patients was level 1 in 18 patients, level 2 in 117 patients, level 3a in 11 patients, and level 3b in 6 patients. All 6 patients at level 3b had head injuries, and one patient had concurrent fracture.

The incidence of falls by risk level was 1.1% (41 of 3791 patients) at risk level I, 6.8% at risk level II, and 21.5% at risk level III; the incidence of falls increased significantly as the risk level increased (Table 2). Multiple logistic regression analysis using presence of falls as dependent variable and all the items in the fall assessment sheet as independent variables identified age, history of fall, tendency to act without pressing nurse call button, unstable gait, unstable when standing, and use of narcotic as risk factors of falls (Table 3).

Table 2 Number (rate) of patients with falls by risk level

| Risk level | Score | No. of patients (n = 5219) | No. of falls (n = 152) | Rate (%) |
|------------|-------|-------------------------------|---------------------------|----------|
| I | 0 – 3 | 3791 | 41* | 1.1 |
| II | 4 – 9 | 1335 | 91* | 6.8 |
| III | 10 – | 93 | 20* | 21.5 |

*P < 0.0001

Table 3 Assessment items identified as risk factors of falls

| | | | Odds ratio | 95% confidence interval | P value |
|-------------------------|-------------------|---|------------|-------------------------------|---------|
| Patient characteristics | Age | 70 years or above | 3.68 | 1.96 – 6.88 | <0.0001 |
| | Past history | Experienced fall in the past | 1.91 | 1.28 – 2.87 | 0.0017 |
| | Personality | Tends to act without pressing nurse call button | 1.71 | 1.01 – 2.89 | 0.0449 |
| Patient condition | Physical function | Can walk independently, but gait is unstable | 2.06 | 1.35 – 3.17 | 0.0009 |
| | | Unstable when standing without support | 1.81 | 1.14 – 2.88 | 0.0120 |
| | Drug use | Is using narcotic | 3.35 | 1.03 – 10.91 | 0.0444 |

Odds ratio were obtained by multivariate logistic regression analysis (stepwise method) using all the assessment items as independent variables.

AUC = 0.81397

We examined the effect of older age on the incidence of falls and impact of falls by dividing patients into those aged 70 years or above (n = 1958) and those aged below 70 years (n = 3261). The number of patients with falls was 122 (6.2%) among older patients aged 70 or above, and 30 (0.9%) among patients aged below 70 years, showing a significant difference (p < 0.0001). Ninety-two older patients (4.7%) aged 70 years or older had risk level III, while 1

patient (0.0%) aged below 70 years had risk level III, with a significant difference ($p < 0.0001$) between the two groups.

DISCUSSION

The incidence of falls during hospitalization has been estimated to be between 3 and 13 falls per 1000 bed days, and approximately one in three people who fall in hospital sustains an injury.⁶ In the present study, the fall rate was 2.45 falls per 1,000 patient-days, which is lower than previous report. The lower fall rate is probably attributed to a larger proportion of young patients and the effective preventive measures in our hospital, such as nursing care plans for high-risk patients.

In this study, analysis of the age distribution of patients with falls showed that the majority of them were older patients aged 65 years and above. Previous study has reported that most people who have falls in acute care hospitals are over 70 years of age.⁷ Muscle strength decreases with ageing, and the most marked reduction is seen in the lower limbs. Since decrease in lower limb muscle strength causes a decline in dynamic balance ability, consequently older people are more likely to fall, which requires special attention.

In the present study, the most frequent location of falls was the bedside at 68%, and falls occurred not only during daytime, but many also occurred during nighttime. Simokura et al⁸ reported that falls often occurred during night shifts and in patients' rooms, and that there were many falls occurring in the vicinity of the bed at night, similar to our results.

Many assessment tools for predicting falls have been reported. Among them, St. Thomas's risk assessment tool is a widely used tool consisting of five items: history of falls, patient's mental state, visual impairment, frequency of toilet use, and mobility, and is assessed by a nurse.⁴ The Morse Fall Scale is also a tool with confirmed predictive validity, and is composed of six items: fall history, secondary diagnosis, ambulatory aid, heparin lock, gait ability, and mental status.⁵ The predictive validity of both of these assessment tools has been confirmed in both acute care and maintenance care settings.⁹ In Japan, however, different facilities usually use tools that are independently created or modified based on the fall assessment sheet proposed by the Japanese Nursing Association,¹⁰ and there is currently no fall assessment tool that it is widely used and has been evaluated carefully for validity. Aryee et al¹¹ reported that the male sex, a history of joint replacement, psychotropic agents, and a history of falls were risk factors for injurious falls. In addition, Kobayashi et al¹² reported that a multivariate logistic model identified age over 80 years, history of fall, and use of slippers as risk factors for falls. Consistent with the finding of Kobayashi et al, multiple logistic regression analysis in the present study also identified age and a history of fall as risk factors of falls in hospital, but several additional risk factors related to falls were identified. Accurate assessment of risk factors is necessary for the development of a simpler and more accurate risk assessment tool.

There were several limitations in the present study. The results of the present study cannot be generalized, because patients hospitalized in our hospital tended to skew toward a large proportion of surgical patients, especially orthopedic surgery patients; the number of falls recorded was relatively small; and data was collected from a single facility. In addition, since the risk of falls changes constantly due to many factors including changes in medical conditions after admission, clinical course, effects of pain, environmental factors, and footwear, time series analysis of risk assessment is a topic of future research. In this study, the outcome included both falls on the same level and falls to a lower level. However, there is a big difference between falling down from a bed (to a lower level) and falling due to losing balance while standing or

walking (at the same level). It is necessary to clarify the definitions of both types of fall and the countermeasures for them. In addition, the assessment tool used this study is influenced by the assessor's subjectivity, and there are items that are difficult to make objective and accurate judgment. There is room for improvement.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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