



Original Article

Rehabilitation in a convalescent rehabilitation ward following an acute ward improves functional recovery and mortality for hip fracture patients: a sequence in a single hospital

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Abstract. [Purpose] The convalescent rehabilitation ward (CRW) plays an important role for hip fracture patients in Japanese super-aged society. The purpose of this study is to clarify the usefulness of the CRW concomitant with acute wards in a single hospital. [Subjects and Methods] 110 hip fracture patients were evaluated; 63 patients were moved from acute wards to the CRW in the same hospital (Group C) and 47 patients were treated in acute wards only (Group A). Patient selection was determined by each attending doctor. The outcomes were examined from medical records. [Results] 90.5% of patients in the group C were discharged to home and 57.4% in the group A. 92.9% of patients in the group C had regained their ambulatory ability at discharge and 88.9% in the group A. The average total functional independence measure scores at discharge were 96.4 in the group C and 85.0 in the group A. The one-year mortality was 2.4% in the group C and 8.3% in the group A. [Conclusion] Using a CRW concomitant with acute wards in a single hospital could achieve a high home-discharge rate, good functional recovery, and low mortality in hip fracture patients.

Key words: Convalescent rehabilitation ward, Hip fracture

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INTRODUCTION

Japan has been a super-aged society since 2007 when over 21-percent of the total population was over 65 years old^{1,2}. The increase in osteoporosis patients has recently become a topic of discussion and a serious social problem in Japan. The convalescent rehabilitation ward (CRW) system started in Japan in 2000³. At the same time, the public long-term care insurance system was established⁴. This legal system aimed to support elderly people who must undergo rehabilitation and live their chronic phase lives after discharge from the CRW. The CRW is a subacute-phase-particularized rehabilitation ward. In Japan, more than 57,000 CRW beds (about 50 beds for every 100,000 people) were available in 2009, about 4.5% of the total inpatient beds in Japan³. Our hospital started a CRW with 39 beds in September 2004 and it has increased to 58 beds.

Post-operative patients in the acute ward receive care from nurses and acute-phase rehabilitation from physical-therapist (PT) and occupational therapist (OT) as much as possible. The CRW receives patients as early as possible from other acute hospitals and acute wards in the same hospital. Patients in the sub-acute stage who need long-term rehabilitation move to the CRW and undergo intensive rehabilitation under the care of a professional team composed of doctor, nurse, PT, OT, speech therapist, medical social worker, clinical psychotherapist, nutritionist and so on. In the CRW ideal rehabilitation directly

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Table 1. Patient background in two groups

Patient characteristics		Group C		Group A	
Number		63		47	
Age (yrs)		82.0 ± 8.4		81.4 ± 8.8	
Gender	Male	12	(19.0)	7	(14.9)
	Female	51	(81.0)	40	(85.1)
Diagnosis	Femoral neck fracture	26	(41.3)	25	(53.2)
	Trochanteric fracture	37	(58.7)	22	(46.8)
Residence*	Home	59	(93.7)	34	(72.3)
	Nursing home	4	(6.3)	13	(27.7)
Walking ability	Independent gait	25	(39.7)	23	(48.9)
	Cane	13	(20.6)	8	(17.0)
	Walker	18	(28.6)	5	(10.6)
	Wheel chair	7	(11.1)	11	(23.4)

Values are mean ± SD or as n (%)

CRW: convalescent rehabilitation ward

*Significant difference ($p < 0.01$) between group C and group A

linked to activities of daily living (ADL) in the ward is considered equally important to rehabilitation in the training room¹). In our hospital, patients in the CRW undergo rehabilitation about 2–3 hours per day every day including holidays. The final goals of the patients in the CRW are good recovery of their mobility that was reduced by trauma or diseases and being able to return home. Eventually this system intends to reduce the increase in bedridden patients in Japan's super-aged society¹).

Inevitably hip fractures (trochanteric and femoral neck fractures) due to osteoporosis are also increasing. These fractures have a major impact as one of the factors that lead to decrease in the ADL of aged people⁵) and increase in their mortality rate^{6, 7}). Surgery and rehabilitation for hip fractures are directly linked up to the functional recovery of patients. From this point of view, the CRW plays a very important role in recent Japanese society. There are some reports that have discussed the effectiveness of rehabilitation in the CRW for stroke patients in Japan^{8, 9}), but few for hip fracture patients. Momosaki et al. only reported the results of the CRW for hip fracture patients based on the Japanese database in 2015¹⁰).

There are two models of the CRW. One is concomitant with acute wards in a hospital, the other is in a rehabilitation hospital. Our hospital is an acute hospital with both an acute ward and a CRW. There is little literature focused on consequent rehabilitation using the CRW following acute wards in a single hospital like ours.

The purpose of this study was to clarify the usefulness of the CRW concomitant with acute wards in a single hospital.

SUBJECTS AND METHODS

In our hospital, a total of 124 patients with a hip fracture were treated between 2012 and 2013. The inclusion criterion was a patient with a hip fracture who underwent surgery. Exclusion criteria were patients younger than 60 years old, pathological fracture, high-energy trauma, moving to another hospital before surgery, receiving conservative therapy, death during hospitalization, and moving into a long-term care ward in our hospital. We excluded four-teen patients for these reasons: one patient each for pathological fracture, high-energy trauma, moving to another hospital, and receiving conservative therapy; three patients for being younger than 60 years old; four patients for moving into a long-term care ward in our hospital; three patients for death during hospitalization. We enrolled 110 patients in this study. The patients had different medical details: 53 patients had a femoral neck fracture, which in 46 cases were treated by bipolar hemiarthroplasty, and in 5 cases by internal fixation; 59 patients had a trochanteric fracture, which in 59 cases were treated by internal fixation using a short femoral nail, and in one case by a compression hip screw. There is no regular protocol for postoperative rehabilitation in our hospital. The rehabilitation schedule for each patient is prescribed by the surgeon. Some of these patients were not allowed to load weight-bearing on the injured limb in the first 2–4 weeks after internal fixation because their fracture was unstable. Most patients were able to get out of bed with in a few days of surgery. Hip fracture patients who have surgery receive acute peri-operative care in the acute ward first. When their condition is considered stable, they can move to the CRW. Patients not requiring long-term rehabilitation are discharged from the acute ward. Therefore, all the patients are divided into two groups; the group of patients who are discharged from the CRW and the other group of patients who are discharged from the acute ward. Patient selection was determined by each attending doctor with regard for every situation around the patient. Of these patients, 63 (average age 82.0 ± 8.4 years, 51 females and 12 males) were moved to the CRW and eventually discharged from there (group C). The remaining 47 (average age 81.4 ± 8.8 years, 40 females and 7 males) were treated in and discharged from the acute ward (group A). Then we compared groups C and A. The characteristics of each group are summarized in Table 1. Information on the patient's function and residence before the fracture was obtained by interview from patients or a

Table 2. Patient outcomes in two groups

			Group C		Group A	
		Length of hospital stay *	83.8	± 24.0	24.1	± 7.2
		Length of acute care ward stay	26.8	± 9.8	—	—
At moving to the CRW	Walking ability	Independent gait	1	(1.6)	—	—
		Cane	7	(11.1)	—	—
		Walker	21	(33.3)	—	—
		Wheel chair	34	(54.0)	—	—
At discharge	Residence *	Home	57	(90.5)	27	(57.4)
		Nursing home	5	(7.9)	18	(38.3)
		Hospital	1	(1.6)	2	(4.3)
	Walking ability	Independent gait	2	(3.2)	1	(2.1)
		Cane	29	(46.0)	24	(51.1)
		Walker	25	(39.7)	7	(14.9)
		Wheel chair	7	(11.0)	15	(31.9)

Values are mean ± SD or as n (%)

CRW: convalescent rehabilitation ward

*Significant difference ($p < 0.01$) between group C and group A

family member on admission. There was a significant difference in the residence before injury in the two groups according to the Mann-Whitney U-test ($p < 0.05$).

The examined outcomes were total length of hospital stay, residence after discharge, walking ability at moving to the CRW in the case of group C and at discharge in both groups, functional independence measure (FIM) scores on admission and at discharge in both groups, FIM scores at moving to the CRW in group C, the number of patients who died after discharge, average follow-up period, and survival curve. Residence state was classified in 3 grades: (1) home, (2) nursing home, (3) geriatric hospital. Walking ability was classified in 4 grades: (1) walk independently, (2) walk with a cane, (3) walk with a walker, (4) use a wheelchair. We defined patients belonging (1) or (2) or (3) as being with ambulatory ability. The FIM score (ranging from 18 to 126) is a basic indicator of disability severity and is popular among almost all rehabilitation staff and in hospitals in Japan. The FIM is composed of 18 items, each of which is scored from 1 to 7 points. The higher the score means the more independent the person is. The FIM score is subdivided into a 13-item motor subscale and a five-item cognitive subscale. The motor FIM score range is from 13 to 91, and the cognitive FIM score range is from 5 to 35¹⁰). Walking ability and the FIM score at moving to the CRW and at discharge were collected from medical records made during hospitalization. Information on whether the patient was alive or dead at the time of last observation was obtained from medical records. Kaplan-Meier curves with the end point regarded as death were obtained, and one-year mortality was calculated.

Informed consent was obtained from all patients who approved the use and publication of their data. This study was approved by our institution's ethics review board.

Total length of hospital stay and FIM scores at discharge in each group were compared in the two-sample t test. Residence and ambulatory ability at discharge were compared in the Mann-Whitney U test. FIM scores at moving to the CRW and at discharge in group C were compared in the paired t test. Kaplan-Meier Curves of two groups were compared in log-rank test. Statistical analysis was performed using SPSS Statistics (version 22; IBM Corp., Armonk, NY, USA). The probability level for statistical significance was $p < 0.05$.

RESULTS

Average length of hospital stay was 83.8 ± 24.0 days in the group C, and 24.1 ± 7.2 days in group A. The length of stay in group C was significantly longer ($p < 0.01$). Average length of acute care ward stay in group C was 26.8 ± 9.8 days. Residence at discharge of each group is shown in Table 2. There was a significant difference between the groups, 90.5% of patients in group C were discharged to home and 57.4% of patients in group A were discharged to home ($p < 0.01$). The walking ability of patients at moving to the CRW and at discharge is shown in Table 2. There was no significant difference in the distribution of walking ability at discharge ($p = 0.412$). At discharge, 92.9% of patients in group C had regained ambulatory ability and 88.9% of patients in group A. Changes in the FIM scores are shown in Table 3. At discharge, each FIM score in group C was significantly higher than in group A. In addition, in group C each FIM score at discharge was significantly improved compared to that at moving to the CRW. One patient from group C and three patients from group A had died at the time of last observation. The average and standard deviation of the follow-up period was 441 ± 256 days for group C and 331 ± 235 days for group A. The follow-up period of group C was significantly longer ($p < 0.01$). Excluding patients who died, 64.5% (40/62) of patients in group C and 56.8% (25/44) of group A could be followed up for more than a year. Kaplan-Meier curves

Table 3. Transition of FIM scores in two groups

	Group C			Group A		
	FIM Total Score	FIM Motor	FIM Cognitive	FIM Total Score	FIM Motor	FIM Cognitive
On admission	49.9 ± 15.5	24.4 ± 10.0	25.2 ± 8.6	50.3 ± 22.2	27.2 ± 14.1	23.1 ± 10.6
At moving to the CRW	80.0 ± 22.6	53.5 ± 16.1	26.5 ± 7.7	—	—	—
At discharge ***	96.4 ± 24.4	68.7 ± 18.6	29.0 ± 11.3	85.0 ± 33.2	59.9 ± 24.1	24.6 ± 10.1

Values are mean ± SD

CRW: convalescent rehabilitation ward

*Significance different ($p < 0.05$) between group C and group A in each score

**Significance different ($p < 0.05$) between at moving ward and at discharge in each score in the group C

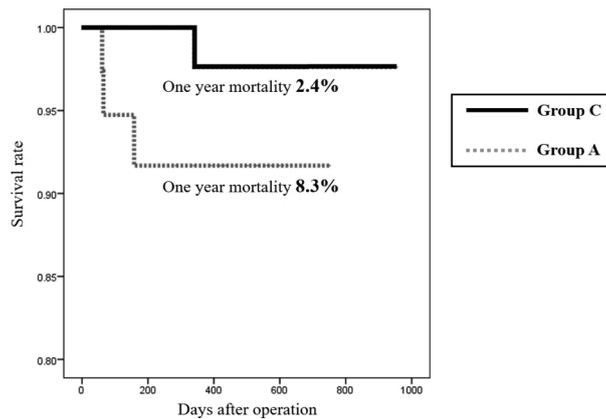


Fig. 1. Kaplan-Meier curves of group C and group A

There was no significant difference between the two groups in the log-rank test ($p = 0.123$).

of each group are shown in Fig. 1. The one-year mortality of group C was 2.4% and that of group A was 8.3%. There was no significant difference between the two groups in the log-rank test ($p = 0.123$).

DISCUSSION

Use of the CRW is restricted by Japanese national health insurance to a limited set of diseases including stroke, spinal cord injury, hip fracture, post-operative hip and knee arthroplasty, and some kinds of disuse syndrome. The purposes of their coverage are to increase the home discharge rate, recovery of mobility of patients, and as a result, reduction of medical costs. There are some criteria for a hospital to start and maintain a CRW, for example, enough medical staff, including at least one psychiatrist, and some degree of severity in patients. A high home discharge rate of patients is also required for a CRW, 60% to 70%, and the rate is different for each hospital. Our hospital requires a home discharge rate of more than 70%. Regarding this, the home discharge rate of hip fracture patients in the CRW in this study was 90.5%, which was very high and also suitable for Japanese national health insurance; the home discharge rate of the CRW in this study achieved one of the goals of CRWs.

The another goal for the patients in the CRW is to achieve functional recovery from their worsened situation due to trauma or diseases. We discussed whether patients in the CRW in our hospital were able to achieve the goal comparing to the patients discharged from acute ward.

Changes in patients' walking ability and FIM score were investigated to evaluate their reacquisition of function. Although there was no significant difference between the two groups in their walking ability at discharge, the proportion of patients that had ambulatory ability was higher in group C than that in group A. There was no statistically difference in each FIM scores on admission. The FIM scores at discharge in group C were significantly higher than those of group A. In addition, the motor FIM score and total FIM score at discharge had improved compared to that at moving to the CRW in group C. In group C, continuation of intensive rehabilitation for about three months from admission to discharge enabled patients to regain their former walking ability. Furthermore, the cognitive FIM score at discharge in group C significantly improved over those at moving to the CRW. These data may be one evidence indicating the usefulness of the CRW. Not only walking training by PTs but also enough ADL training by OTs might have contributed to the improvement in the patients' cognitive function.

The rate of regaining ambulatory ability is one of the evaluation criteria of inpatient rehabilitation. Some of the results in

the CRW had been reported in Japan. Banno et al. reported that 86.2% of the orthopedic patients in a CRW acquired ambulatory ability¹¹). Oishi et al. reported that 54.3% of hip fracture patients in a CRW acquired ambulatory ability¹²). Although there may have been a little difference between hospitals in the evaluation method, the result of this study was 92.9% which is a good result compared to the previous reports in Japan. Factors leading to these good results in group C are features of rehabilitation in our CRW. One of the features is the considerable number of rehabilitation staff. Abundance of staff make it possible for patients to receive sufficient rehabilitation according to institutional criteria even on holidays not just weekdays, which led to good results from our CRW.

Hip fractures are associated with excess mortality immediately after the fracture and in the long term. The one-year mortality rate of the patients was investigated in this study. There have been some reports on one-year mortality in hip fracture patients both in Japan and other countries. Clinical practice guidelines in Japan mention that the one-year mortality of Japanese hip fracture patients has been 9.8% to 10.8%¹³). In contrast, the mortalities reported in other countries are slightly higher than that of Japan. Deschodt et al. investigated mortality to evaluate the effect of an inpatient geriatric consultation team. One-year mortality of patients with geriatric intervention and usual care were 21.3% and 22.1%, respectively¹⁴). Hung et al.'s study in a university hospital in Taiwan reported one-year mortality of 12.4%¹⁵). Kannegaard et al. reported that one-year mortality was 37.1% in male hip fracture patients and 26.4% in females in a nationwide register-based cohort study in Belgium¹⁶). Morin et al. reported that one-year mortality was 36.4%, using healthcare databases for the province of Manitoba, Canada¹⁷). In a similar study using a government database, Seitz et al reported that it was 36.4% in Ontario, Canada¹⁸). From a retrospective cohort analysis of pseudonymized invoice data from Austrian social insurance authorities covering roughly 98% of the entire population, Brozek et al. reported it was 20.2%¹⁹). Mundi et al. performed a literature review from 2000 in North America, and the average of one-year mortality was 20%²⁰). Although there are some differences between the health care systems in each country, the results of both groups in our study were better than the results of these reports. In particular, it is notable that one-year mortality in Group C was below 5%.

The difference in home discharge rate between two groups was significant. This is a proper result that is to be expected by purpose of the CRW system. We consider that this leads to the reduction of the final and total medical costs.

Moving to another hospital to receive more rehabilitation might cause anxiety in patients. Especially for elderly patients, changing the environment and staff is stressful for them. But, moving to another ward in the same institution might be better for patients in that regard. As well, medical staff, including doctors, can continue treatment for the patients. Consistent systems until discharge such as in our hospital are able to provide a hospitable medical service to the patients and their families. Furthermore, it is possible for doctors to construct a trusting relationship with their patients.

We provided consistent treatment for hip fracture patients from acute to chronic phase in a single institution using a convalescent ward. Rehabilitation for a long enough period and by a lot of staff could improve their activity of daily living and home discharge rate. In Japan's super-aged society, a convalescent rehabilitation ward as a follow-up for acute wards in a single hospital can play an important role.

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