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Original article

The cause of failure to return to the pre-fracture place of residence and solution to continue medical treatment for osteoporosis following an operation for hip fracture – Periodic observation of single center

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Abstract

The purpose of this study was to investigate the causes of failure to return to the pre-fracture place of residence at hospital discharge following an operation for a hip fracture and to continue medical treatment for osteoporosis. Herein, we discuss methods for improving discharge protocols for these patients.

We examined patients who sustained osteoporotic fractures and were operated on for a hip fracture between 2001 and 2003 (83 males and 386 females; 81.2 ± 9.0 years old) and between 2011 and 2013 (121 males and 462 females; 83.1 ± 9.3 years old). In a follow-up study, we examined patients who moved into our related rehabilitation institution over a 3-year period, from 2011 to 2013.

The incidence of hip fractures had increased from 2001–2003 to 2011–2013 in both genders, and it tended to increase in patients greater than 80 years of age in male and 90 years of age in female. The most common destination residence after discharge from the rehabilitation institution was the pre-fracture place of residence. The Barthel Index at discharge from the rehabilitation institution was significantly lager in patients who returned to the pre-fracture place of residence compared to those who returned to nursing home and our hospital. These results suggest improved mobility and ADL level of patients enable them to return to the pre-fracture place of residence.

We propose the construction of a feedback system that aids in a medical pass to increase the ambulant consultation rate for orthopedics and prevent fragile fractures.

Keywords: Osteoporosis; Hip fracture; Hospital discharge

1. Introduction

Osteoporosis increases the risk of fragile fractures, most notably in the proximal femur, vertebrae and wrist, and it is a major social problem. It was estimated that as many as 9 million fragile fractures occurred through the world in 2000 [1]. Due to increased life span and with the presumption of a constant age-specific rate of fracture in both men and women, the incidence of hip fractures is estimated to increase to 6.3 million in 2050 [2]. When surgery is applied, the incidence of postoperative complications is so high that the reported 1-year mortality rate during the rehabilitation period is 30% [3,4]. Furthermore, hip fracture is associated with high morbidity (20% death) and mortality (50% institutionalization) within the first year following the injury [1]. Considering that an incidence of clinical fracture recurrence within 2 years after any clinical fracture is 10.8% [5], the goal of fragile fracture therapy should be treatment of osteoporosis to prevent future fractures, with elimination of bone loss and maintenance of

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bone strength. However, the barriers to care, including age, dementia, medical co-morbidities, polypharmacy, lack of adherence to therapy, delirium, economical situation, ignorance and incuriosity about osteoporosis, discourage effective osteoporosis management [6]. Therefore, ambulant consultation for orthopedics after hospital discharge is indispensable for these patients, especially for patients who were operated on for a hip fracture. Nevertheless, regional alliances to provide outpatient care for these patients are lacking in Japan. In North America, Europe and Oceania, the incidence of hip fractures has plateaued in the last two decades, and age-adjusted decreases in the incidence of these fractures have been reported in some centers. In contrast, age-adjusted hip fracture rates continue to rise in Japan and some other countries [7]. The purpose of the present study was to investigate the causes of failure to return to the pre-fracture place of residence at hospital discharge following an operation for a hip fracture and to continue medical treatment of osteoporosis. Herein, we also discuss methods for improving the discharge protocols for these patients.

2. Materials and methods

We examined patients who sustained hip fractures and were treated operatively at our hospital and reeducated at our rehabilitation institution between January 2001 and December 2003 and between January 2011 and December 2013. A flow sheet of examination items analyzed in this study is shown as Table 1.

2.1. Examination of patients who sustained hip fractures and were treated operatively at Kawakita general hospital

Unstable femoral neck fractures were treated by hemiarthroplasty, and stable femoral neck fractures were fixed with cannulated cancellous hip screws or Hansson's pins. Trochanteric fractures were treated with internal fixation using a gamma-fractures nail type device and, in some cases, a compression hip screw. All procedures in this study were in accordance with the ethical standards of the responsible committee on human experimentation of the authors' institution and with the Helsinki Declaration of 1975, as revised in 2008. Informed written consent was obtained from all patients who were treated operatively.

The numbers and percentages of hip fractures and other fragile fractures, and the age distribution of hip fractures that occurred over two 3-year periods, from 2001 to 2003 and from 2011 to 2013, were compared between genders. Based on place of residence following discharge from our hospital, patients treated for hip fractures were divided into four groups: pre-fracture place of residence (home of their own, including persons living alone and living together), our affiliated rehabilitation institution, a nursing home (nursing and personal care facility), and hospital mortality. When the patients from a nursing home returned there, they were counted to return to a nursing home. The place of residence following discharge from our hospital was decided by deliberation of medical doctors, physical therapists, medical social workers, patients' family and patients themselves if possible. The numbers and percentages of patients in each group were compared between genders over two 3-year periods. The patients under and over 80 years of age were also compared. Furthermore, the destination residence of patients treated for hip fractures at our hospital from 2011 to 2013 was compared based on fracture site: femoral neck fractures (FNFs) treated operatively, mainly with hemiarthroplasty, and trochanteric fractures treated with fixation using a gamma-nail type device.

Table 1
A flow sheet of examination items analyzed in this study.

I. Examination of patients who sustained hip fractures and were treated operatively at Kawakita general hospital. Over two 3-year periods, from 2001 to 2003 and from 2011 to 2013.
1. The numbers and percentages of hip fractures and other fragile fractures
2. The age distribution of hip fractures that occurred over two 3-year periods
3. The residences of patients treated for hip fractures after discharge.
4. The residences of patients under and over 80 years of age who were after discharge.

From 2011 to 2013.
1. The destination residence of the patients compared based on fracture site: femoral neck fractures (FNFs) and trochanteric fractures

II. Examination of patients who were treated for fractures of the proximal femur at Kawakita general hospital and moved into the related rehabilitation institution over a 3-year period, from 2011 to 2013.
1. The destination residence of the patients after discharge from the rehabilitation institution.
2. The number of patients who returned to the pre-fracture place of residence following discharge and visited the orthopedics department at Kawakita general hospital and their ambulant consultation rate.
3. The destination residences following discharge from the rehabilitation institution compared in every decade.
4. the Barthel Index at admission and at hospital discharge from the rehabilitation institution

2.2. Examination of patients who were treated for fractures of the proximal femur at Kawakita general hospital and moved into the related rehabilitation institution

In a follow-up study, we examined patients who were treated for fractures of the proximal femur at our hospital and moved into our related rehabilitation institution over a 3-year period, from 2011 to 2013. These patients were divided into three groups based on place of residence following discharge from the rehabilitation institution: pre-fracture place of residence, a nursing home, and return to our hospital for treatment for other diseases. The number of patients in each group and the age distribution of these groups were compared. Level of mobility and activity of daily living (ADL) were evaluated using the Barthel Index at admission and at hospital discharge from our related rehabilitation institution. The ambulant consultation rate of patients who returned to the pre-fracture place of residence from the rehabilitation institution and visited the orthopedics department at our hospital from 2011 to 2013 was calculated.

2.3. Statistical analysis

A Mantel–Haenszel procedure was used to compare the numbers and percentages of hip fractures and other fragile fractures over two 3-year periods, from 2001 to 2003 and from 2011 to 2013, the age distribution of hip fractures that occurred during the 2 observation periods, the residences of patients treated for hip fractures after discharge from our hospital, and the residences of these patients under and over 80 years of age. A Friedman test was used to compare the destination residences of the patients who were treated for hip fractures at our hospital based on the fracture site, the destination residences of patients who were treated for hip fractures at our hospital and moved into our related rehabilitation institution, and the destination residences of these patients following discharge from the rehabilitation institution in every decade. In comparison between the Barthel Index of the patients indicated by median at admission and at discharge from the rehabilitation institution, which was classified by the residences of these patients after discharge, a Kruskal–Wallis test was used. Furthermore, the Barthel Index of each group at discharge from the rehabilitation institution was compared using a Scheffe's F test. The ambulant consultation rate of patients who returned to the pre-fracture place of residence following discharge from the rehabilitation institution and visited the orthopedics department at our hospital, was also compared by a Kruskal–Wallis test. Differences were statistically significant when $p < 0.05$.

3. Results

The numbers and percentages of hip fractures and other fragile fractures in both genders over two 3-year periods, 2001 to 2003 and 2011 to 2013, are summarized in Table 2. There was a significant difference between the incidence of hip fractures and other fragile fractures over the two periods ($p < 0.05$). The incidence of hip fractures increased from 2001–2003 to 2011–2013 in both genders. The age distribution of patients who sustained hip fractures during the 2 observation periods are summarized in Table 3. There was no significant difference in the age distribution of incidence of hip fractures, however, it tended to increase in patients greater than 80 years of age in male and 90 years of age in female. The residences of patients treated for hip fractures after discharge from our hospital in both genders are summarized in Table 4 and their residences under and over 80 years of age in Table 5. There was no significant difference between the residences of these patients after discharge in both genders regardless of age (comparing patients under and over 80 years of age) during both periods. However, the percentage of patients who returned to nursing homes, which are residential facilities that care for persons with predominant difficulties in ADL, tended to increase from 2001–2003 to 2011–2013. Additionally, there was a tendency that the percentage of patients who were under 80 years of age and returned to the pre-fracture place of residence increased between these two periods, and instead, the percentage of patients who moved into the rehabilitation institution decreased regardless of gender and age.

The destination residences of patients treated for hip fractures at our hospital from 2011 to 2013 were compared based on fracture site, and the results are summarized in Table 6. There was no significant difference in the destination residences of patients with FNFs. However, there was a significant difference in those of patients with trochanteric fractures through the observation periods ($p < 0.05$). The percentage of patients who returned to nursing homes increased, and that of patients who moved into our related rehabilitation institution decreased in the trochanteric fracture group over 3-year periods. Meanwhile, there was a significant difference in the percentages of the different destination residences following discharge from the rehabilitation institution through the observation periods ($p < 0.05$), and the rate of return to the pre-fracture place of residence increased from 66.3% to 74.0% (Table 7). Furthermore, there was a significant difference in the age-group in the destination residences following discharge from the rehabilitation institution ($p < 0.05$) (Table 8). Approximately 80–90% of patients at each destination residence were over 80 years of age. The Barthel Index indicated by median at

Table 2
The numbers and percentages of hip fractures and other fragile fractures over two 3-year periods, from 2001 to 2003 and from 2011 to 2013.

	Number (%)	
	2001–2003	2011–2013
Male		
Hip fractures	83 (8.7)	121 (13.3)
Other fragile fracture	154 (16.1)	108 (11.9)
Female		
Hip fractures	386 (40.4)	462 (50.8)
Other fragile fracture	332 (34.8)	218 (24.0)
Total	955 (100.0)	909 (100.0)

There is a significant difference between the incidence of hip fractures and other fragile fractures over the two periods by comparison using a Mantel-Haenszel procedure ($p < 0.05$).

Table 3
The age distribution of hip fractures that occurred during the 2 observation periods.

	Number (%)	
	2001–2003	2011–2013
Male (years old)		
50–59	9 (1.9)	15 (2.6)
60–69	5 (1.1)	14 (2.4)
70–79	33 (7.0)	18 (3.1)
80–89	27 (5.8)	58 (9.9)
90<	9 (10.8)	16 (2.7)
Female (years old)		
50–59	5 (1.1)	11 (1.9)
60–69	41 (8.7)	25 (4.3)
70–79	90 (19.2)	85 (14.6)
80–89	173 (36.9)	215 (36.9)
90<	77 (16.4)	126 (21.6)
Total	469 (100.0)	583 (100.0)

There is no significant difference between the age distribution of this fracture over two 3-year periods by comparison using a Mantel-Haenszel procedure.

Table 4
The residences of patients treated for hip fractures after discharge from our hospital.

	Number (%)	
	2001–2003	2011–2013
Male		
Pre-fracture place	29 (34.9)	35 (28.9)
Rehabilitation institution	41 (49.4)	44 (36.4)
Nursing home	9 (10.8)	41 (33.9)
Hospital mortality	4 (4.8)	1 (0.8)
Female		
Pre-fracture place	100 (25.9)	113 (24.5)
Rehabilitation institution	225 (58.3)	148 (32.0)
Nursing home	50 (13.0)	194 (42.0)
Hospital mortality	11 (2.8)	7 (1.5)
Total	469 (100.0)	583 (100.0)

There is no significant difference between the residences of these patients after discharge during both periods by comparison using a Mantel-Haenszel procedure.

Table 5
The residences of patients under and over 80 years of age who were treated for hip fractures after discharge from our hospital.

	Number (%)	
	2001–2003	2011–2013
80 y<		
Pre-fracture place	61 (13.0)	104 (17.8)
Rehabilitation institution	176 (37.5)	187 (32.1)
Nursing home	37 (7.9)	219 (37.6)
Hospital mortality	12 (2.6)	8 (1.4)
80 y >		
Pre-fracture place	68 (14.5)	44 (7.5)
Rehabilitation institution	90 (19.2)	5 (0.9)
Nursing home	22 (4.7)	16 (2.7)
Hospital mortality	3 (0.6)	0 (0.0)
Total	469 (100.0)	583 (100.0)

There is no significant difference between the residences of these patients after discharge during both periods by comparison using a Mantel-Haenszel procedure.

Table 6
The destination residences of the patients who were treated for hip fractures at our hospital based on the fracture site.

	Number (%)		
	2011	2012	2013
FNF			
Pre-fracture place	30 (16.8)	30 (18.8)	29 (14.9)
Rehabilitation institution	41 (22.9)	29 (18.1)	40 (20.6)
Nursing home	31 (17.3)	36 (22.5)	47 (24.2)
Hospital mortality	1 (0.6)	1 (0.6)	1 (0.5)
Trochanteric fracture			
Pre-fracture place	19 (10.6)	12 (7.5)	16 (8.2)
Rehabilitation institution	31 (17.3)	16 (10.0)	19 (9.8)
Nursing home	23 (12.8)	35 (21.9)	41 (21.1)
Hospital mortality	3 (1.7)	1 (0.6)	1 (0.5)
Total	179 (100.0)	100 (100.0)	194 (100.0)

There is no significant difference in the destination residences of patients with FNFs, however, there is a significant difference in the destination residences of patients with trochanteric fracture by comparison using a Friedman test ($p < 0.05$).

Table 7
The destination residences of patients who were treated for hip fractures at our hospital and moved into our related rehabilitation institution.

	Number (%)		
	2011	2012	2013
Pre-fracture place	63 (66.3)	55 (66.3)	71 (74.0)
Ambulant consultation	19	13	14
Hospital treatment	11 (11.6)	9 (10.8)	9 (9.4)
Nursing home	21 (22.1)	19 (22.9)	16 (16.7)
Total	95 (100.0)	83 (100.0)	96 (100.0)

There is a significant difference in the percentages of the different destination residences following discharge from the rehabilitation institution through the observation periods by comparison using a Friedman test ($p < 0.05$).
The number of patients who returned to the pre-fracture place of residence following discharge from our related rehabilitation institution and visited the orthopedics department at our hospital is populated in the table. The ambulant consultation rate observed over 3-year periods is 30.2, 23.6 and 19.7%, respectively. There is no significant difference in the rate by comparison using a Friedman test, however, a trend of reduction from year to year is observed.

Table 8
The destination residences following discharge from our related rehabilitation institution compared in every decade.

Years old	Number (%)		
	Pre-fracture place	Hospital treatment	Nursing home
50–59	2 (1.1)	0 (0.0)	1 (1.8)
60–69	7 (3.7)	1 (3.5)	0 (0.0)
70–79	31 (16.4)	5 (17.2)	4 (7.1)
80–89	103 (54.5)	13 (44.8)	30 (53.6)
90<	46 (24.3)	10 (34.5)	21 (37.5)
Total	189 (100.0)	29 (100.0)	56 (100.0)

There is a significant difference in the age-group in the destination residences following discharge from the rehabilitation institution by comparison using a Friedman test ($p < 0.05$).

admission and at hospital discharge from our related rehabilitation institution was summarized in Table 9. There was a significant difference in median of the Barthel Index of each group at admission and at hospital discharge from the rehabilitation institution ($p < 0.01$). Furthermore, the Barthel Index at discharge from the rehabilitation institution was significantly lager in order of patients who returned to the pre-fracture place of residence,

Table 9
The Barthel Index indicated by median at admission and at discharge from our related rehabilitation institution.

Barthel index	At admission	At hospital discharge
Pre-fracture place	60	85
Hospital treatment	45	0
Nursing home	35	60

** ** **

There is a significant difference in median of the Barthel Index of each group at admission and at hospital discharge from the rehabilitation institution compared using a Kruskal–Wallis test ($p < 0.01$).
Furthermore, the Barthel Index at discharge from the rehabilitation institution compared using a Scheffe's F test is significantly lager in order of patients who returned to the pre-fracture place of residence, transferred to nursing home and required hospitalization.
**$p < 0.01$.

were transferred to nursing home and required hospitalization ($p < 0.01$). These results suggest improved mobility and ADL level of patients enable them to return to the pre-fracture place of residence, followed by transfer to nursing home. For patients who returned to the pre-fracture place of residence after discharge from the rehabilitation institution from 2011 to 2013, the number and ambulant consultation rate, the rates of visitation of the orthopedics department at our hospital, are summarized in Table 7. No significant differences in the ambulant consultation rate were observed over 3-year periods, but a trend of reduction from year to year was observed. In these patients who returned to the pre-fracture place of residence, 28 patients (14.8%) suffered the second fracture of the opposite site of the hip treated with hemiarthroplasty during the 3-year observation periods.

4. Discussion

Detailed evaluation of the incidence of hip fracture in Japan was undertaken in Tottori prefecture between 1986 and 2001 [8]. Significant increases in the age-specific incidence rate of fracture were observed in both genders over that period, and this trend continued through to the most recent follow-up, with age- and sex-specific rates of fracture rising up to 3.8% per year [9]. These results, which suggest continuing age-adjusted increases in Japan, are quite different from those in the nearby countries of Hong Kong and Singapore, where the rate of fracture appears to have plateaued [10]. In this study, the incidence of hip fractures had increased from 2001–2003 to 2011–2013 in both genders, and it tended to increase in patients greater than 80 years of age in male and 90 years of age in female. When the residences of these patients after discharge from our hospital were examined between the two study periods, there was a tendency that the percentage of patients who returned to nursing homes had increased in both genders regardless of age, and the percentage of patients less than 80 years of age who returned to the pre-fracture place of residence increased. These results suggest the importance of care after discharge from the hospital for elderly people, especially for those over 80 years of age with predominant difficulties in ADL, to facilitate the ability to return to the pre-fracture place of residence. Although there was no significant difference in the destination residences of patients with FNFs, there was a significant difference in those of patients with trochanteric fractures through the observation periods. The percentage of patients who returned to nursing homes increased, and that of patients who moved into our related rehabilitation institution decreased in the trochanteric fracture group over 3-year periods. Generally, hemiarthroplasty is indicated for patients with FNFs, for whom walking exercise can be started from early postoperative period, however, open reduction and fixation is applied to patients with trochanteric fractures, whose weight bearing is delayed especially in the unstable fractures, resulting in a delay of ADL recovery and increase of return to nursing homes.

A previous multivariable logistic regression analysis showed that increased age, dementia and a lower level of mobility were the most important risk factors for failure to return to the pre-fracture place of residence at discharge in patients who lived in their own home prior to the hip fracture [11]. In contrast, in residential home patients, age was identified as the only risk factor for failure to return to the pre-fracture place of residence, which may have been due to the small study population. Similar studies have identified the presence of a partner, good general health, good cognition, a higher level of ADL and mobility at pre-fracture and at 2 weeks postoperatively, a lower number of medications, and moderate use of nursing interventions as important factors for increases in the chance of patients returning to their pre-fracture place of residence following discharge from the hospital [12–15]. Those previous results are in line with ours, which suggest the possibility that even elderly persons over 80 years of age can return to their pre-fracture place of residence when their ADL and mobility have been increased sufficiently by undergoing rehabilitation immediately after surgery for hip fracture. Indeed their mobility and ADL level as indicated by the Barthel Index was as high as 79.1/100 and was higher at hospital discharge than at admission. These results suggest that major risk factor for failure to return to the pre-fracture place of residence at hospital discharge following an operation for a hip fracture and to continue medical treatment for osteoporosis is not patients' age but their poor mobility and low level of ADL, that prevent their opportunity for hospital visit for therapy directed at osteoporosis. Therefore, rehabilitation aims to restore the ADL of patients up to the level to allow for return to the pre-fracture place of residence is essential. Some limitations of this study should be noted. We could not analyze the therapeutic rate of osteoporosis, evaluate dementia and trace database to examine family structure including living-alone or living-together. We must address these problems as future issues.

Even when these patients can return to their pre-fracture place of residence, they need therapy for osteoporosis to prevent repetitive fractures, especially at the opposite femur [16]. Indeed, in our study in patients who returned to the pre-fracture place of residence 14.8% suffered the second fracture of the opposite site of the hip treated with hemiarthroplasty during the 3-year observation periods. Because bisphosphonates have reduced the incidence of hip fractures in osteoporotic patients to 40% [17,18], we should aim to provide these patients and their family with guidance through ambulant consultation with regards to the need for therapy for osteoporosis after hospital discharge and rehabilitation facility discharge to decrease the incidence of repetitive hip fractures. In addition to an educational campaign regarding treatment for osteoporosis and fragile fracture in elderly persons, we propose cooperation between hospitals performing operations for hip fractures and neighboring medical institutions. We have made use of the medical pass for treatment of hip fractures, including osteoporosis therapy. That is, when patients who were operated on for hip fractures (the acute phase of treatment) are discharged from the hospital and enter convalescent facilities, datebooks that describe not only therapeutic proceedings but also evaluation data and prescriptions for osteoporosis are sent to the convalescent facilities. After patients

have moved into the pre-fracture place of residence or a nursing home, these datebooks are used for therapy in the maintenance phase and the patients' therapeutic situation is reported to our hospital. Thus, we propose the construction of a feedback system that aids in this medical pass being used for treatment of both hip fractures and osteoporosis at local medical institutions to increase the ambulant consultation rate and prevent recurrence of such fractures.

5. Conclusion

The results of this research suggested that major risk factor for failure to return to the pre-fracture place of residence at hospital discharge following an operation for a hip fracture and to continue medical treatment for osteoporosis is not patients' age but their poor mobility and low level of ADL, that prevent their opportunity for hospital visit for therapy directed at osteoporosis. Therefore, rehabilitation aims to restore the ADL of patients up to the level to allow for return to the pre-fracture place of residence is essential. Furthermore, considering that in patients who returned to the pre-fracture place of residence 14.8% suffered the second fracture of the opposite site of the treated hip during the 3-year observation periods, we propose the construction of a feedback system that aids in the medical pass which is used for treatment of both hip fractures and osteoporosis at local medical institutions to increase the ambulant consultation rate and prevent recurrence of such fractures.

Conflicts of interest

All named authors hereby declare that we have no conflicts of interest to disclose.

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