7) 投与期間は

□[148] _____年 [149] _____カ月位 □[150] 決まっていない

8) 治療効果は何によって判定されますか（最も適当なもの）

□[151]疼痛の改善 □[152]骨量増加 □[153]骨代謝マーカー □[154]新規骨折抑制

□[155]その他（ ）[156]

１３．大腿骨頚部・転子部骨折患者の術後の治療について

1)骨粗鬆症治療薬の投与を行いますか

□[157]行う □[158]行わない（質問１４へ） □[159]どちらともいえない

2)「行う」場合に選択する薬剤は何が多いですか？

多いものを3つ選択して下さい（多い方から □ に 1、2、3 を記入）

□[160]カルシウム剤 □[161]エストロゲン製剤 □[162]ビタミンD_3製剤

□[163]カルシトニン製剤 □[164]イプリフラボン □[165]ビタミンK

□[166]蛋白同化ホルモン □[167]ビスフォスフォネート製剤（エチドロネート[1]）

□[168]ビスフォスフォネート製剤（アレンドロネート[2]、リセドロネート[3]）

□[169]ＳＥＲＭ（ラロキシフェン[4]）

□[170]その他（ ）[171]

([1]ダイドロネル、[2]フォサマック、ボナロン、[3]アクトネル、ベネット、[4]エビスタ）

１４．骨粗鬆症の圧迫骨折により脊髄麻痺を呈した症例を経験されたことがありますか

□[172]ある □[173]ない

１５．今後高齢化が進むにあたって整形外科において骨粗鬆症は

□[174] 疾患のなかでも重要な位置を占めていく
□[175] あまり重要な疾患とはならない
□[176] わからない

１６．骨粗鬆症健診・骨ドックなど啓発活動に参加されたことがありますか

□[177]ある　　□[178]ない

１７．高齢者の転倒による骨折の予防について

1）高齢者の転倒による骨折とその予防に関心がありますか。

□[179]かなりある　□[180]多少ある　□[181]あまりない　□[182]ない

2）高齢者の転倒による骨折の予防に有望と思われるものを選んで下さい（複数回答可）

□[183]骨粗鬆症薬　□[184]栄養指導　□[185]運動指導
□[186]ヒッププロテクター　□[187]その他（　　）[188]

3）上記2)で「骨粗鬆症薬」を選んだ方へ。
以下の薬剤のうち**転倒の**予防に有効と考えられるものを選んで下さい(複数回答可)。

□[189]カルシウム剤　□[190]エストロゲン製剤　□[191]ビタミンD_3製剤
□[192]カルシトニン製剤　□[193]イプリフラボン　□[194]ビタミンK
□[195]蛋白同化ホルモン　□[196]ビスフォスフォネート製剤（エチドロネート[1]）
□[197]ビスフォスフォネート製剤（アレンドロネート[2]、リセドロネート[3]）
□[198]ＳＥＲＭ（ラロキシフェン[4]）　□[199]その他（　　）[200]
□[201]転倒を予防する薬剤は上記には無い
□[202]わからない

(1) ダイドロネル、2)フォサマック、ボナロン、3)アクトネル、ベネット、4)エビスタ)

4）ヒッププロテクターは、転倒時に大転子部を保護して大腿骨頚部・転子部骨折を予防する目的で開発された製品ですが、ご存じですか。

□[282]よく知っている □[283]見たことがある □[284]聞いたことがある
□[285]知らない（質問7）へ）

5) ヒッププロテクターで大腿骨頚部・転子部骨折が予防できると思いますか。

□[286]かなりできる □[287]多少できる □[288]あまりできない □[289]できない
□[290]わからない

6) 転倒による骨折の予防について何かご意見がありましたらご記入下さい。[291]

18．日常診療での骨粗鬆症の診断・治療の問題点、今後の整形外科医の役割分担について御意見をお書きください。[292]

ご協力ありがとうございました。
返信用封筒に入れて、ご返送下さい。

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研究成果の刊行に関する一覧表

雑誌

発表者氏名	論文タイトル名	発表誌名	巻号	ページ	出版年
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Original article

Report on the Japanese Orthopaedic Association's 3-year project observing hip fractures at fixed-point hospitals

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Abstract

Background. The aim of this study was to assess the disability and mortality of hip fractures 1 year after initial visit (postoperatively) at fixed-point hospitals selected by the Japanese Orthopaedic Association Committee on Osteoporosis.

Method. A total of 158 core orthopedic hospitals were selected for participation in this research. Subjects were all aged 65 years and older with hip fractures at the selected hospitals between January 1, 1999 and December 31, 2001. A prognostic survey of activities of daily living (ADL), assessed by the long-term care insurance criteria established by the Ministry of Health, Labour, and Welfare of Japan was performed 1 year after the initial visit.

Results. A total of 10992 hip fractures in patients aged 65 to 111 years were treated over the 3 years from 1999 to 2001. Among the 10992 patients, 4537 had femoral neck fractures and 6217 had trochanteric fractures. Surgical treatment was chosen for 85.6% of the femoral neck fractures and 88.2% of the trochanteric fractures. The mean duration from fracture to admission was 3.1 days, and the mean duration from admission to surgery was 11.2 days. The mean duration from surgery to discharge over the 3-year period was 49.8 days. Before hip fracture, the ratio of patients with J1 ("able to go out freely utilizing public transportation") or J2 ("able to visit immediate neighbors independently") on the long-term care insurance criteria was 50.9%. At 1 year after the initial visit, that result represented a decrease of 24.1 percentage points before hip fracture. A total of 70 patients died before undergoing surgery. In the present study, the 1-year mortality rate for the entire patient population over the 3-year period was 10.1%.

Conclusions. Hip fracture patients show a decrease in the ADL score 1 year after the initial visit. Compared to other countries, the duration of hospitalization is longer in Japan, but the mortality rate is lower.

Introduction

Hip fracture is an important cause of morbidity and mortality among the elderly. For the first time, under the leadership of the Japanese Orthopaedic Association (JOA), an epidemiological study on hip fracture was commenced in 1997 by the Committee on Osteoporosis of the JOA (hereafter referred to as the Committee). Because the number of investigated items is limited in this annual epidemiological study, a fixed-point observation project involving core orthopedic hospitals was started in 1999 (including patients treated between January 1 and December 31) to examine a larger number of factors including the 1-year prognosis. Herein, we report the results of fixed-point observation for hip fractures occurring over the 3-year period from 1999 to 2001.

Selection of institutions for fixed-point observation

In October 1999, the Committee began selecting core orthopedic hospitals at which to observe and analyze

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treatments for hip fracture in Japan. After taking into account the regional factors, a total of 160 institutions were identified in February 2000. These institutions were contacted for participation in the fixed-point observation project, with only two institutions declining. Subsequently, a total of 158 institutions were designated fixed-point observation institutions.

Subjects and methods

Subjects were all patients with hip fracture and aged 65 years old and older treated at one of the participating institutions between January 1 and December 31, 1999. A prognostic survey was performed 1 year postoperatively (hereafter referred to as the 1-year prognosis survey). Survey sheets for hip fractures occurring over the 3-year period were collected.

The survey ascertained the following information: sex; height; body weight; cause of fracture; living situation at the time of fracture; date of fracture; date of admission; date of surgery; location where fracture occurred; discharge status; outcomes; side and type of fracture; treatment; independence in activities of daily living (ADL) both before fracture and 1 year postoperatively (at the time of the 1-year prognosis survey, and assessed according to the long-term care insurance[1] criteria established by the Ministry of Health, Labour, and Welfare of Japan); preoperative complications; and past history of fracture. The study was designed to ensure patient anonymity.

Data were analyzed using of variance with the *t*-test and the continuity adjusted chi-squared test. Statistical significance was set at 0.01.

Results

Number of responding institutions for each year

Of the 158 participating institutions, 76 institutions (48.1%) responded during the first year (fractures occurring in 1999), 69 institutions (43.7%) during the second year (fractures occurring in 2000), and 75 institutions (46.2%) during the third year (fractures occurring in 2001). Over the 3-year period, a total of 220 institutions responded, with an annual average of 73.3 institutions (46.4%).

Number of patients over the 3-year period

A total of 12250 hip fractures in patients 0–111 years of age were treated during the 3 years from 1999 to 2001. Among these patients, those 65 years and older (65–111 years of age) were analyzed. At the responding institutions, a total of 3656 patients were treated in 1999, 3393 patients in 2000, and 3943 patients in 2001, for a 3-year total of 10992 patients with an annual average of 3664 patients using those criteria.

Background factors (age at time of fracture)

Among the 10992 patients with known sex and age, the mean age was 81.8 years (79.8 years for male patients, 82.3 years for female patients).

Laterality and type of hip fracture

The incidence of left and right fractures was analyzed for all 3 years. The total numbers of right and left hip fractures over the 3-year period were comparable, at 5414 and 5497, respectively. Over the 3-year period, 3 male patients and 28 female patients presented with bilateral hip fractures. A total of 6217 trochanteric fractures, 4537 femoral neck fractures, 13 patients with both fractures, and 225 with no-response fractures were treated.

Cause of fracture

Among the 10992 patients treated over the 3-year period, the most common cause was "simple fall (fall from a standing level)", accounting for 76.1% ($n = 8362$) (Table 1), followed by a "staircase accident" and "downfall (fall from a high level)", in that order (5.9% and 5.0%, respectively). Most of the hip fractures were caused by falls from a standing level.

Time after fracture

The mean interval from fracture to admission was 2.7 days in 1999, 3.4 days in 2000, and 3.2 days in 2001 (3-year average 3.1 days). The mean duration from admission to surgery was 11.1 days in 1999, 12.3 days in 2000,

Table 1. Causes of fracture (3-year period)

Cause of fracture	No.	%
Body movement while lying down	89	0.8
Fall while standing	8362	76.1
Staircase accident	645	5.9
Downfall	545	5.0
Traffic accident	341	3.1
No recollection	78	0.7
Diaper-related fracture	27	0.2
Spontaneous fracture	102	0.9
Unknown	540	4.9
Other	65	0.6
No response	198	1.8
Total	10992	100

and 10.2 days in 2001 (3-year average 11.2 days). The mean duration from surgery to discharge over the 3-year period was 50.4 days, with a tendency to decrease each year: 52.2 days in 1999 ($P < 0.01$), 49.0 days in 2000, and 48.4 days in 2001 ($P < 0.01$) (Table 2).

Patients who died before undergoing surgery (3-year period)

A total of 70 patients died before undergoing surgery (31 men, 38 women, 1 patient of unknown sex). Table 3 shows living situations and hip fracture types for these patients. The mean age was 85.5 years for the 31 men and 87.5 years for the 38 women. The incidence of trochanteric fracture was about double that of femoral neck fracture, and mean number of complications ranged from 1.9 to 3.2. Although we suspect that more complications arose, only the complications listed on the survey sheets were analyzed.

Treatments and surgery (3-year period)

Among the 10992 patients, 4537 had femoral neck fractures, 6217 had trochanteric fractures, and these was no response for 238 cases. Table 4 shows the breakdown of treatments for femoral neck fracture and trochanteric fracture. Surgical treatment was chosen for 85.6% of femoral neck fractures and 88.2% of trochanteric fractures. Among patients with femoral neck fractures, hemiarthroplasty was performed in 40.7%, total hip arthroplasty in 21.6%, and screw fixation in 15.0%. Among patients with trochanteric fractures, captured hip screw (CHS) fixation was performed in 57.2% and Gamma nailing in 20.4%. These two methods thus accounted for 77.6% of surgeries performed for trochanteric fracture.

ADL independence before hip fracture

In accordance with ADL independence assessment criteria established by the Ministry of Health, Labour, and Welfare of Japan, patients were classified in eight grades, from (1) able to go out freely by utilizing public transportation (J1) to (8) unable to turn over in bed independently (C2). Over the 3-year period, the section for ADL independence was left blank for only 118 patients (1.1%). Preoperatively, the ratio of grade 1 or 2 patients was relatively high, accounting for 50.9% of the total (Table 5).

ADL independence 1 year after initial visit

At 1 year (6 months) after the initial visit, grade 1 patients (able to go out freely by utilizing public transportation) and grade 2 patients (able to visit immediate

Table 2. Time parameters

Parameter	From fracture to admission				From admission to surgery				From surgery to discharge			
	1999	2000	2001	3-Year total	1999	2000	2001	3-Year total	1999	2000	2001	3-Year total
Days	2.7 ± 31	3.4 ± 20.0	3.2 ± 18.0	3.1 ± 16.0	11.1 ± 31.0	12.3 ± 24.0	10.2 ± 40.0	11.2 ± 34.0	52.2 ± 55.0*	49.0 ± 41.0	48.4 ± 49.0*	49.8 ± 42.0
Cases	3656	3393	3946	10 992	3428	3153	3675	10 256	3365	3127	3640	10 132

Results are averages
* $P < 0.01$ (*t*-test)

Table 3. Patients who died without surgery (3-year total)

Patients	Nonsurgical deaths (no.)	Living situation at time of fracture					Neck fracture		Trochanteric fracture	
		Average age (years)	Living alone	Living with family	Living in facility	Unknown	No.	Complications	No.	Complications
Men	31	85.5 ± 8.5	3	9	5	14	11	1.9	20	2.8
Women	38	87.5 ± 6.0	4	7	3	24	14	3.2	24	2.6
Unknown	1	87	1							

Table 4. Treatments and surgery (3-year total)

Treatment	Neck fractures (n = 4537)		Trochanteric fractures (n = 6710)		Unknown (n = 238)
	No.	%	No.	%	No.
No surgery	288	6.3	291	4.7	19
Surgery	3885	85.6	5485	88.2	194
Ender nail	3	0.1	214	3.4	3
Screw	681	15.0	52	0.8	18
Gamma nail	9	0.2	1269	20.4	15
CHS	201	4.4	3556	57.2	59
Plate	1	0	5	0.1	1
Hemiarthroplasty	1847	40.7	164	2.6	42
Total hip arthroplasty	978	21.6	22	0.4	16
Other	110	2.4	118	1.9	13
Unknown	31	0.7	21	0.3	3
Compound	24	0.5	64	1.0	24
No response	364	8.0	441	7.1	25

CHS, captured hip screw

Table 5. ADL independence before fracture

ADL independence before fracture (scores 1–8)	No.	%
1 Able to go out using public transportation	2667	24.3
2 Can go out to visit neighbors	2928	26.6
3 Can go out with assistance and spend the day out of bed	1997	18.2
4 Rarely goes out; spends the day in bed	1971	17.9
5 Uses a wheelchair and only leaves bed to eat or use the bathroom	700	6.4
6 Can get in and out of a wheelchair with assistance	469	4.3
7 Able to turn over in bed independently	67	0.6
8 Unable to turn over in bed independently	46	0.4
Unknown and other	29	0.3
Total responses	10992	100.0
No response	118	1.1

ADL, activities of daily living

neighbors independently — J2) accounted for 12.7% and 14.1%, respectively, for a total of 26.8%. This represented a decrease of 29.5 percentage points from the preoperative score ($P < 0.01$; continuity adjusted chi-squared test). However, the section for ADL independence 1 year after the initial visit was left blank by 2820 patients (25.7%), suggesting difficulties associated with conducting the prognostic survey (Table 6).

Preoperative complications (3-year period)

Many patients with hip fracture develop complications. Of the 10992 patients treated over the 3-year period, the section for preoperative complications was completed for 10908 patients and left blank for 84 patients. Only 882 patients (8.0%) experienced no complications. The most common complication was hypertension, followed by dementia, neuropathy, and heart disease, in that order.

One-year mortality rate for each surgery (3-year period)

Table 7 shows 1-year mortality rates for the various surgical methods. Mortality rate was highest for plate

fixation (14.3%, 1/7), followed by Ender nailing (14.0%) and Gamma nailing (12.3%). Apart from the "Others" category, the 1-year mortality rate was lowest for the screw method, at 7.7%. The mean postoperative mortality rate was 10.1%.

One-year survival rate for each calendar age (3-year period)

Table 8 shows 1-year survival and mortality rates for each year of age from 65 years and older. The number of hip fracture patients exceeded 300 among these 78–90 years of age. The greatest number of patients was 416, at 85 years of age. The 1-year survival rate for patients in their eighties was higher than 80%, whereas that for patients in their nineties was above 70%, confirming that the 1-year survival rate decreases with age.

Table 6. ADL independence 1 year after surgery/initial visit

ADL independence 1 year after surgery/initial visit	No.	%
1 Able to go out using public transportation	1399	12.7
2 Can go out to visit neighbors	1550	14.1
3 Can go out with assistance and spend the day out of bed	1427	13.4
4 Rarely goes out; spends the day in bed	1080	9.8
5 Uses a wheelchair and only leaves bed to eat or use the bathroom	1000	9.1
6 Can get in and out of a wheelchair with assistance	1034	9.4
7 Able to turn over in bed independently	167	1.5
8 Unable to turn over in bed independently	174	1.6
Unknown and other	341	3.1
Total responses	10992	100.0
No response	2820	25.7

Table 8. One-year survival rate for each year of age

Age (years)	Alive (no.)	Deceased (no.)	Survival rate (%)
65	91	3	96.8
66	117	4	96.7
67	109	4	96.5
68	122	3	97.6
69	144	10	93.5
70	150	8	94.9
71	167	10	94.4
72	189	13	93.6
73	172	20	89.6
74	212	23	90.2
75	234	13	94.7
76	250	26	90.6
77	266	15	94.7
78	325	29	91.8
79	333	31	91.5
80	287	35	89.1
81	323	40	89.0
82	318	49	86.6
83	321	42	88.4
84	355	58	86.0
85	356	60	85.6
86	344	66	83.9
87	338	65	83.9
88	344	58	85.6
89	254	61	80.6
90	265	53	83.3
91	198	56	78.0
92	160	50	76.2
93	111	38	74.5
94	107	22	82.9
95	51	26	66.2
96	50	14	78.1
97	43	11	79.6
98	18	3	85.7
99	36	8	81.8
100	13	7	65.0
101	9	4	69.2
102	0	2	0
103	0	0	0
111	1	0	100.0

Table 7. One-year mortality rate for each surgery method

Method	Alive	Deceased	Unknown	Total count	Mortality rate (%)
Surgery					
Ender nail	108	31	81	220	14.0
Screw	512	58	181	751	7.7
Gamma nail	762	159	372	1293	12.3
CHS	2300	381	1134	3815	10.0
Plate	4	1	2	7	14.3
Artificial head replacement	1302	146	604	2052	7.1
Total hip replacement	670	77	269	1016	7.6
Others	162	17	62	241	7.1
Unknown	322	171	506	999	17.1
Nooperation	509	70	19	598	11.7
Total	6651	1111	3230	10992	10.1 (average)

Table 9. Discharge status and 1-year mortality

Discharge status		Alive	Deceased	Unknown	No response	One-year total
Well	9012	6367	555	1122	968	9012
No change	503	282	87	59	75	503
Deceased	397					
Others	1080	2	72	220	786	1080
Total	10992	6651	714	1401	1829	10595

Table 10. Complications and 1-year mortality

		Alive		Deceased		Unknown	
Complications	Total	No.	%	No.	%	No.	%
No	698	583	83.5	41	5.8	74	10.6
Yes	7794	5700	73.1	1045	13.4	1049	13.4
No response	2500	368	14.7	25	1.0	2107	84.2
Total	10992	6651	67.9	1111	16.8	3230	15.1

Table 11. One-year mortality rate and sex

	1999		2000		2001		Total	
Sex	No.	%	No.	%	No.	%	No.	%
Male	115		127		117		145	
Female	270		220		237		242	
No response	16		6		3		10	
Total	401		353		357		1111	
Total patients (mortality rate)	3656	10.9*	3393	10.4	3943	9.0*	10992	10.1

* $P < 0.01$ (continuity adjusted chi-squared test)

Outcomes at discharge and the 1-year prognosis

The 1-year prognosis was investigated based on discharge status for the 10992 patients treated over the 3-year period. Of the 9012 patients discharged in good health, 503 (4.6%) were discharged with unchanged condition, and 396 (4.4%) were dead at discharge. Of the 9012 patients in good health at discharge 555 (6.2%) were dead, and 87 (17.3%) of 503 patients with an unchanged condition were dead, 1 year postoperatively. Of the 1081 patients whose condition at discharge was unknown or left blank, 72 (6.7%) were dead 1 year postoperatively (Table 9).

Comparison of 1-year survival and mortality in relation to complications

The 1-year mortality rate for the 698 patients without complications was 5.8%, compared to 13.4% for the 7794 patients with complications and 1.0% for the 2500 patients for whom the section on complications was left blank (Table 10).

Comparison of 1-year mortality during 3-year period for men and women

The 1-year mortality rate for each year of age among men was 17.3% for the 664 patients in 1999, 19.7% for the 646 patients in 2000, and 16.2% for the 724 patients in 2001. The 1-year mortality rate for the women was 9.4% for the 2858 patients in 1999, 8.1% for the 2716 patients in 2000, and 7.5% for the 3176 patients in 2001. The mortality rate of both sexes was 10.9% for 3656 patients in 1999, 10.4% in 2000, and 9.0% in 2001. The 1-year mortality rate showed a tendency to decrease year by year. ($P < 0.01$, continuity adjusted chi-squared test) (Table 11).

Discussion

In Japan, the first epidemiological study on hip fracture was conducted in 1987 by Orimo et al.,[2] and about 52300 cases of hip fracture were estimated to occur annually each year in Japan. The JOA then took a leadership role and the Committee has conducted annual epidemiological studies on hip fracture since 1997. Between 1998 and 2000, a total of 110747 hip fractures were reported[3] and about 90000 hip fractures are estimated to occur each year in Japan. To supplement these studies, a hip fracture project was started in 1999 at selected hospitals in Japan in an attempt to clarify the 1-year prognosis following hip fracture. Comparing the JOA study and the fixed-point observation project, the project studied about 10% of the number of patients enrolled in the epidemiological study in 1999 and 2000, and the types, laterality, and causes of femoral neck fracture were comparable.

The mean hospitalization for patients with hip fracture in various countries is reportedly 10 days for the Ullevaal hip screw in Norway, 12 days for the Hansson hook-pin in Norway,[4] 10 days for internal fixation in Sweden, 12 days for arthroplasty in Sweden,[5] 17.8 days in England,[6] 18 days in Austria,[7] 20.6 days in Thailand,[8] 24 days in Denmark,[9] 35 days in Italy,[10] and 23.3 days in the United States.[11] In Japan, the mean length of hospitalization is 83.6 days for pinning, 53.0–58.8 days for hemiarthroplasty,[12,13] 83.9 days for CHS,[14] 2.4 months for the Ender procedure, and 1.9 months for DHS or the Gamma nail.[15] Compared to other countries, the length of hospitalization following surgery for hip fracture is longer in Japan. In other countries, once acute-phase surgery for hip fracture is performed, patients are transferred to institutions specializing in rehabilitation, such as nursing homes. As a result, the duration of stay in the orthopedic department is low. In Japan, many hospitals are capable of handling both acute- and chronic-phase care, including rehabilitation, thus resulting in longer stays in the orthopedic department.

Based on data obtained from the fixed-point observation project, the number of days from surgery to discharge decreased each year, from 52.2 days ($P < 0.01$, t-text) in 1999 ($n = 3365$) to 49.0 days in 2000 ($n = 3127$) and 48.4 days ($P < 0.01$, t-test) in 2001 ($n = 3640$). As for the decrease at the hospitalization period, advances in the treatment method and the expansion of facilities after discharge are suspected.

Zückerman et al. developed the functional recovery score (FRS) as a disease-specific health assessment tool.[16] Using this system, they reported that FRS for patients with hip fracture was 88.1 points before fracture, decreasing by 15.8 points to 72.3 points 1 year later.[17] To assess patient function, we used the assessment criteria established by the Ministry of Health, Labour, and Welfare of Japan.[1] Thus, ADL independence was classified into eight grades, from (1) able to go out freely by utilizing public transportation, to (2) able to visit immediate neighbors independently, and (3) able to go out with assistance and spend the day out of bed to (8) unable to turn over in bed independently. ADL independence was assessed preoperatively and 1 year after the initial visit (within 6 months in some cases). Over the 3-year period, grade 1 and 2 patients accounted for 24.3% and 26.6%, respectively, of the patients preoperatively. Thus, 50.9% of patients were able to walk without assistance, but at 1 year after the initial visit grade 1 and 2 patients accounted for 12.7% and 14.1%, respectively, for a total of 26.8%. This represented a decrease of 24.1 percentage points. Of the various types of functional disabilities experienced by patients with hip fracture, the degree of disability in stair climbing is marked.[18] In the Baltimore Hip Study, among 804 patients with hip fracture who were ≥65 years old, 55.6% required assistance climbing five stairs preoperatively, and 89.9% required assistance with the same task 12 months postoperatively. Many studies have documented decreases in independent walking following hip fracture,[4,7,11,12,14,19] and one found that the ratio of patients requiring assistance walking one block was 42.4% preoperatively and 55.2% at 12 months postoperatively. However, the degree of decrease in independence was lower when compared to stair climbing, and degree of decrease in walking 10 feet remained low, at 9.2 percentage points.[19]

Because many elderly patients with a hip fracture experience complications, mortality rates for these patients are markedly higher than in the general cohort.[20,21] The 1-year mortality rate for hip fracture has decreased over the last few decades, from 21.6%,[22] 24.0%,[23] and 27.0%[9,24] during the 1970s and 1980s, to 16.8%,[19] 18.0%,[25] 20.0%[10,25,26] during the 1990s and 10.9%[11] during the 2000s. In the present study, the 1-year mortality rate for the entire patient population decreased every year over the 3-year period, from 10.9% in 1999 to 10.4% in 2000 and 9.0% in 2001 (3-year average 10.1%; 1111 of the 10992 patients were dead 1 year after the initial visit — $P < 0.01$, continuity adjusted chi-squared test). Compared to other countries, the duration of hospitalization is longer in Japan, but the mortality rate is lower.

Acknowledgments. We thank the orthopedic departments of the 158 participating institutions for collaborating in this time-consuming project. Because the project investigated a 1-year prognosis, the study could not have been completed without the assistance of not only orthopedic surgeons but also numerous other health care professionals. We express our deepest gratitude to all the individuals who assisted us in undertaking this project. This project was funded by the Scientific Research Grant Program adminis-

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特集

大腿骨頸部骨折の危険因子と予防　Review

大腿骨近位部骨折の疫学

萩野　浩*

我が国における大腿骨近位部骨折の患者数は80～84歳が最多であるが，年齢階級別の発生率は加齢とともに指数関数的に上昇する。最近の全国調査によれば，受傷の原因は立った高さからの転倒が最も多く，68.8%が屋内で受傷し，夏季に比べて冬季に発生率が有意に高い。90%以上の症例が手術的加療を受け，頸部（内側）骨折では約3/4の症例で人工骨頭（関節）置換術が選択されている。日本人を含めたアジア人での発生率は，北欧や米国の白人のものより低値であるが，近年上昇傾向にある。

Epidemiology of Hip Fracture.

Tottori University, Faculty of Medicine, Tottori University Hospital, Rehabilitation Division

Hiroshi Hagino

Age- and gender-specific numbers of patients with hip fracture increase with age and peaked at the age 80-84 ; however, age- and gender-specific incidences increase exponentially with age. According to the recent nation-wide survey, the most common cause of hip fractures was a simple fall, 68.8% sustained fractures indoors, and the incidences were higher in the winter than the summer period. More than 90% of patients with hip fracture were treated surgically and about 3/4 of patients with femoral neck fractures were treated with hemi-arthroplasty. Hip fractures for Asian people including Japanese are lower than those for Caucasians living in Northern Europe and North America ; however, recent reports from the Asian area indicated an increase in the incidence with time.

はじめに

大腿骨近位部骨折の患者は急増しており，その原因は人口構成の高齢化である。我が国の人口は今後も高齢化が進み，老年人口（65歳以上）は2010年に23%，2030年には30%に達し，そのピークは2043年頃である（図1）[1]。従って大腿骨近位部骨折の患者数は今後も増加が続くと予想される。本稿では，これまで我が国で行わ

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た大腿骨近位部骨折の疫学調査結果を中心に，本骨折の発生状況と将来予測を示す。

年齢階級別の患者数

日本整形外科学会では，1998年から全国の認定研修施設および臨床整形外科有床診療所を調査対象に，大腿骨近位部骨折の調査を行っている。

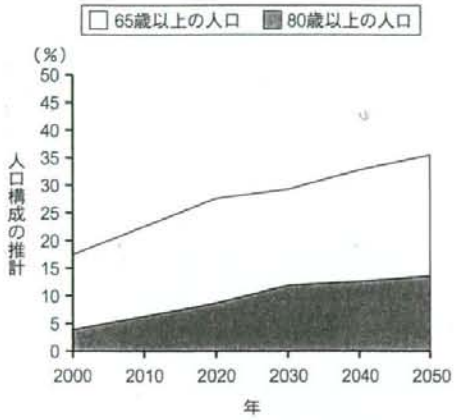

図1　我が国おける人口構成の推計

日本の将来推計人口（平成14年1月推計）を示す。
（文献1より作成）

1998～2000年の調査結果[2]では110,747例（35際以上）が登録され，女性が男性の3.7倍であった。年齢階級別の患者数は，80～84歳が最多であった（**図2**）。骨折型別患者数は，頸部（内側）骨折が47,853例（44%），転子部（外側）骨折が61,632例（56%）（骨折型不明1,262例）で，大腿骨近位部骨折全体では転子部骨折が頸部骨折よりも多かった。受傷側は右が53,713例，左が56,090例，両側895例（左右不明944例）で，左側が多い傾向が見られた。

発生率

近年，我が国で行われた各地域での全数調査や全国規模でのサンプリング調査によれば，大腿骨近位部骨折の発生率は50歳以下では男女とも人口10万人当たり10以下でその発生はごく少なく，60歳以上で徐々に発生率が増加し，70歳以降に指数関数的に上昇する（**図3**）[3][4]。鳥取県での1998～2001年の調査結果では，75～79歳では女性で505.8（年間人口10万人当たり），80～84歳では1,115.4，85歳以上では2,066.4に達する。

骨折型別の発生率は，70歳代前半までは頸部

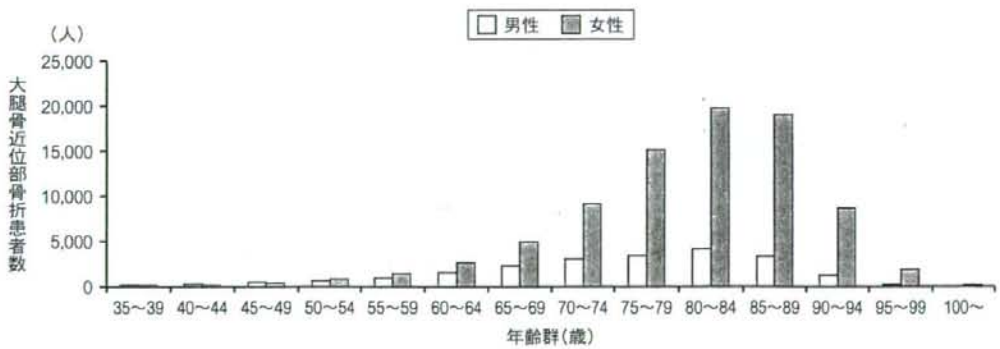

図2　大腿骨近位部骨折の年齢階級別の患者数

患者数は80～84歳が最多で，80歳代が全体の半分を占める。

（文献2より）

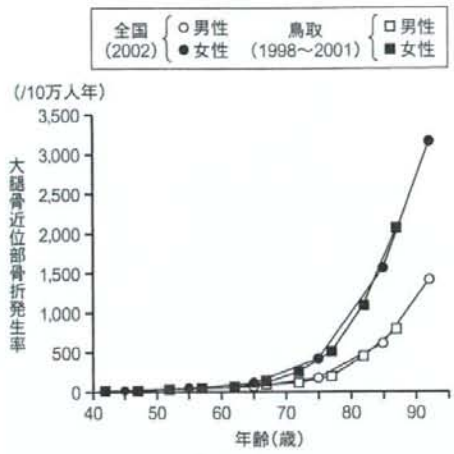

図3　年齢階級別大腿骨近位部骨折発生率

50歳以下では男女とも人口10万人当たり10以下で大腿骨近位部骨折の発生はごく少なく，60歳以上で徐々に発生率が増加し，70歳以降に指数関数的に上昇する。
（文献3，4より作成）

（内側）骨折と転子部（外側）骨折に差はないが，70歳代後半から転子部骨折の方が高値となる。85歳以上の女性の発生率は，頸部骨折が625.2であるのに対して，転子部骨折は1,388.2と2.2倍である（図4）[4]。

受傷の原因

日本整形外科学会の調査では受傷原因も明らかとされ，74%が「立った高さからの転倒」であった（図5）[2]。不明，記憶無し，交通事故を除くと，87.9%で転倒が原因であった。受傷場所は屋内が68.8%を占め，80歳以上の超高齢者群ではさらに屋内で受傷する割合が85%と高かった。

季節変動

季節変動については，有意な変動が観察されるとする報告や，季節性が見られなかったとする報告があり，地域によって結果が分かれる。日本整形外科学会の全国調査によれば，夏季に比べて冬

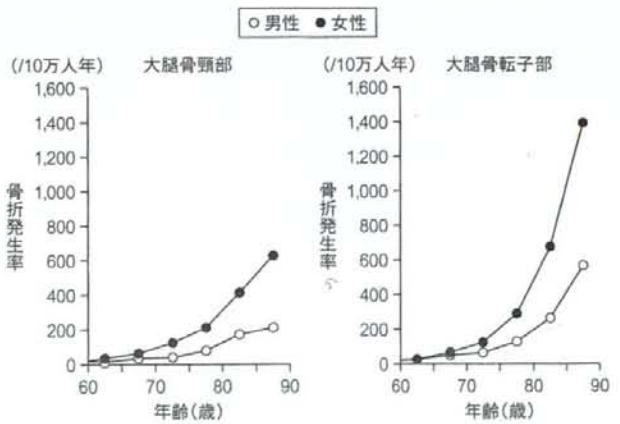

図4　大腿骨近位部骨折の骨折型別，性・年齢階級別の発生率

70歳代前半までは頸部骨折の発生率が転子部骨折よりも高値であるが，70歳代後半から転子部骨折の方が高値となる。頸部骨折よりも転子部骨折の方が骨粗鬆症とより関連が深い。
（文献4より作成）

季に発生率が有意に高い[2]。冬季に本骨折が多く発生する理由としては，寒いため着衣が多く転倒しやすいこと，血中ビタミンDが冬季に低下し，骨の脆弱化や筋力低下をきたす可能性，低温となると低血圧を生じ，転倒頻度が増加することなどが考えられる。

治療法選択の現状

我が国では頸部骨折の93.3%，転子部骨折の94.1%で観血的治療が選択されている[2]。頸部骨折では73.8%の症例で人工骨頭（関節）置換術が選択され，転子部骨折では97.4%に骨接合術が選択されている。

諸外国との比較

日本以外のアジア地域や，欧米での発生率調査結果をもとに，人口補正した発生率を**表1**に示す[5]。日本人を含めたアジア人での発生率は，北欧や米国の白人のものより明らかに低値である。これは大腿骨近位部骨折に限らず，前腕骨骨折，上腕骨近位部骨折でも同様である。そこで，日本人の転倒発生率が欧米白人に比べて低いことが，骨折発生率低値の理由と考えられるに至っている。

経年的推移

鳥取県での1986～1988年，1992～1994

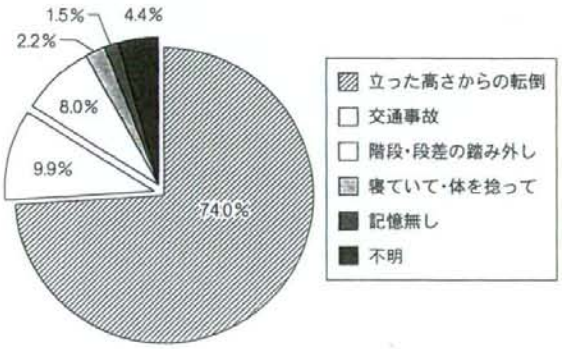

図5　大腿骨近位部骨折の受傷原因

全国調査での大腿骨近位部骨折101,112例の受傷原因の調査結果では74%が「立った高さからの転倒」であった。不明，記憶無し，交通事故を除くと87.9%で転倒が原因であった。

（文献2より作成）

表1　各国の四肢骨折発生率の比較

地域（国）	大腿骨近位部骨折		前腕骨折		上腕骨近位部骨折	
	男性	女性	男性	女性	男性	女性
ロチェスター（米国ミネソタ州）	147	335	89	438	54	161
マルメ（スウェーデン）	173	405	166	766	91	221
ダンディーオックスフォード（英国）	97	273	73	330	36	63
鳥取（日本）	54	155	57	196	21	52
香港（中国）	52	136	−	−	−	−
クアラルンプール（マレーシア）	48	72	−	−	−	−
ホーナン（韓国）	28	25	−	−	−	−
イダバン（ナイジェリア）	1	1	2	2	−	−

数値は1995年の日本人人口構成（35歳以上）補正した発生率（年間10万人当たり）

（文献5より改変）

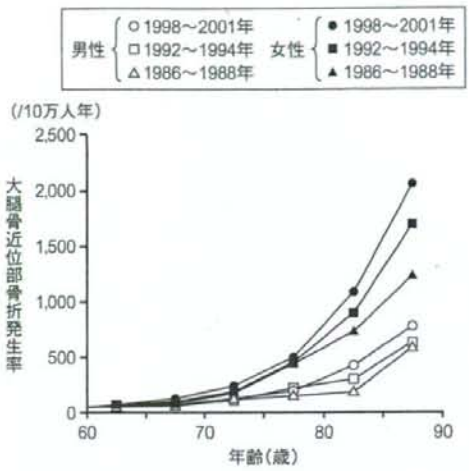

図6　鳥取県での大腿骨近位部骨折発生率の経年推移

鳥取県での1986～1988年，1992～1994年，1998～2001年の年齢階級別発生率を比較した結果によれば，80歳以上の女性での経年的な上昇が著しく，統計学的に有意な経年的発生率上昇があった。

(文献4より)

年，1998～2001年の年齢階級別発生率を比較した結果によれば，80歳以上の女性での経年的な上昇が著しく，統計学的に有意な経年的発生率上昇があった(図6)[4]。また，5年ごとに推計解析が行われている全国調査結果でも，1987～2002年間に発生率の上昇が観察されている[3]。

国外でも，シンガポール，韓国，ホンコン，台湾などのアジア諸国では，骨折発生率が経年的に上昇している。シンガポールでは1960～1990年代にかけて発生率が5倍以上に上昇し[6]，韓国でも1991～2001年の10年間で4倍の発生率上昇があった[7]。これに対して北欧や北米では以前には発生率上昇の傾向が見られたが，近年では変化がないという報告が多い[8]。

このように，地域や人種によって骨折発生率やその推移にばらつきがあり，都市化が進んだ地域ほど発生率が高いことが知られている。発生率の推移に影響する重要な要因として，身体活動性の低下，飲酒量や催眠鎮静剤の服用頻度の増加があげられ，これらは骨脆弱化の進展や転倒の危険性を高め，骨折発生率上昇の一因となると推測される。

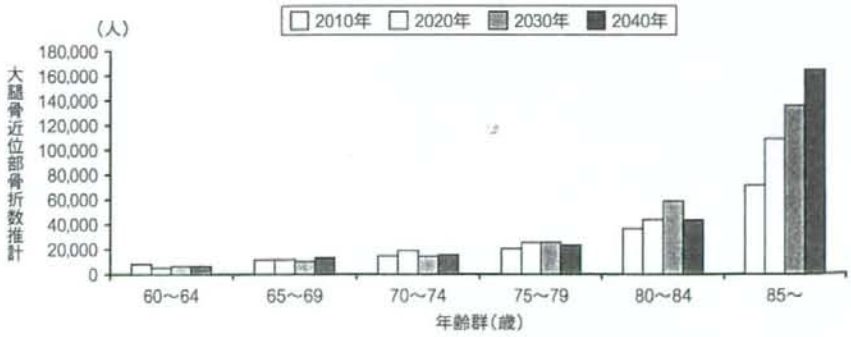

図7　大腿骨近位部骨折の年齢階級別患者数の将来予測

我が国における現在の年齢階級別発生率に基づき，発表されている将来人口推計に従って計算すると，2005年1年間に約14万例大腿骨近位部骨折が発生すると推計され，2030年には25万人に達すると推計され，中でも85歳以上の超高齢患者で特に増加が著しい。

(筆者作成)

おわりに

我が国における現在の年齢階級別大腿骨近位部骨折発生率に基づき，発表されている将来人口推計に従って計算すると，2005年1年間に約14万例大腿骨近位部骨折が発生すると推計され，2030年には25万人に達すると推計される。患者数の増加は85歳以上の超高齢患者で特に著しいが(図7)，年齢別の発生率上昇が今後も続けば患者数増加に拍車がかかることになる。一方，北米では，骨粗鬆症の適切な診断と骨吸収抑制剤による治療によって，大腿骨近位部骨折や橈骨遠位部骨折の発生率が近年低下していると報告されている[9]。我が国でも大腿骨近位部骨折発生のリスク評価と，それに応じた予防戦略が急務である。

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Changes in Serum 25-hydroxycholecalciferol and Intact Parathyroid Hormone Status after Hip Fracture

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Summary. **The purpose of the study was to examine changes in the levels of serum 25-hydroxychole calciferol (25-OHD) and other biochemical markers in response to hip fracture. Serum 25-OHD, serum intact parathyroid hormone (intact PTH), serum N-terminal crosslinking telopeptide of type I collagen (NTx), and urine NTx were measured during a 6-month period after fracture in 11 patients with acute hip fracture. Bone mineral density (BMD) of the non-fractured hip was measured by dual-energy X-ray absorptiometry (DXA). Serum and urine were sampled at admission, on the day of surgery, and two weeks, four weeks, and either three months or six months after fracture. The mean change in the serum 25-OHD levels was less than ± 10% after fracture. Intact PTH levels after three months were higher than those after two weeks or six months, and intact PTH after six months was higher than after two weeks, the mean change being ± 20%. Urine NTx levels changed until four weeks after fracture, and individual differences were observed; insufficient urine NTx data were obtained for analysis after four weeks, though the changes in the urine NTx level after four weeks were small. Changes in serum NTx were smaller than those in urine NTx and similarly showed no significant changes during the measurement period. In conclusion, serum 25-OHD did not show large changes during hip-fracture healing.**

Key words — 25-OHD, intact PTH, NTx, hip fracture.

INTRODUCTION

The number of cases of hip fracture has been increasing with the aging of society [1], necessitating methods for its prevention. The serum 25-hydroxy cholecalciferol (25-OHD) concentration is an index that reflects nutritional status as determined by the level of vitamin D, which is an important nutrient for bone health and a regulator of calcium metabolism. Vitamin D deficiency leads to an increase in parathyroid hormone (PTH) levels – resulting in bone loss [2], and subclinical vitamin D deficiency is considered to be a risk factor for osteoporotic hip fracture in the elderly; [3,4,5,6] these facts give importance to an evaluation of the vitamin D level in osteoporotic patients with hip fracture. An association of vitamin D with normal bone formation has been established, but there are insufficient data regarding serum 25-OHD changes after hip fracture, and the relationship between 25-OHD levels and hip-fracture healing remains unclear. In evaluating serum 25-OHD in hip-fracture patients, the influence of the fracture on the value of serum 25-OHD and other biochemical markers must be considered. Thus, the aim of this study was to examine the levels of 25-OHD and other biochemical markers, including serum intact parathyroid hormone (intact PTH) and serum and urine N-terminal crosslinking telopeptide of type I collagen (NTx), in patients after acute hip fracture.

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Abbreviations – ALT, alanine aminotransferase; AST, aspartate aminotransferase; BMD, bone mineral density; CLIA, chemiluminescence immunoassay; DXA, dual-energy X-ray absorptiometry; ELISA, enzyme-linked immunosorbent assay; NTx, N-terminal crosslinking telopeptide of type I collagen; PTH, parathyroid hormone; RIA, radioimmunoassay; 25-OHD, 25-hydroxycholecalciferol.

SUBJECTS AND METHODS

Subjects

Patients with a fresh fracture of the femoral neck who were admitted to a particular general hospital in Niigata, Japan, from February to September 2004 were invited to participate in a prospective study of recovery from hip fracture. Twenty-six patients were recruited, and 15 of these patients could be followed. However, two of the 15 patients were excluded because they had taken active vitamin D_3 before the fracture, and two more patients were excluded because of malignant disease and liver damage, respectively, leaving an enrollment of 11 patients. The average age of the 11 patients (three males and eight females) was 75.3 ± 11.2 years old (range, 55-91 years old); none suffered from renal, liver or malignant disease. The participants took no active vitamin D_3 for six months after the fracture, with the time limit defined by the final blood examination, and serum levels of 25-OHD, intact PTH and NTx, and the urine NTx level were determined during this period. Written consent for participation in the study was obtained from all patients.

Serum, urine, and bone mineral density (BMD) measurements

Serum and urine samples were collected at admission, on the day of surgery, and two weeks, four weeks and three months or six months after the fracture occurred. The average period from fracture to admission was 3.9 days (range, 0-12 days), and the average period from admission to surgery was 3.5 days (range, 1-8 days). Conservative therapy was used for one patient. The blood and urine samples were assayed for NTx, and blood samples were assayed for intact PTH and 25-OHD. The samples were collected in the morning. Serum calcium, serum phosphorus, and serum total protein were determined at admission, using standard methods. Serum creatinine, alanine aminotransferase (ALT), and aspartate aminotransferase (AST) levels were checked to examine liver and renal function. The BMD of the non-fractured hip was measured by dual-energy X-ray absorptiometry (DXA) (Hologic, QDR Delphi, Bedford, MA, USA).

Table 1. Subject characteristics

Subject number	Gender	Age (years)	BMD of hip (g/cm^2)	Serum total protein (g/dl)	Serum albumin (g/dl)	Serum Ca (mg/dl)	Serum iP (mg/dl)	Serum creatinine (mg/dl)
1	F	55	0.703	6.9	4.3	8.9	3.1	0.6
2	F	70	0.443	5.6	3.1	8.0	2.9	0.4
3	M	91	0.330	5.6	3.1	8.2	2.7	0.4
4	F	88	0.586	5.8	3.7	8.6	3.4	0.5
5	F	80	0.554	6.8	4.3	8.9	3.8	0.4
6	F	74	0.589	6.3	4.0	8.7	2.5	0.5
7	M	83	NE*	7.6	3.0	8.1	2.8	1.5
8	F	78	0.595	6.7	NE	8.8	3.0	0.4
9	M	58	0.630	6.1	NE	8.2	2.6	0.5
10	F	79	NE	7.7	NE	9.1	3.5	0.7
11	F	72	0.806	6.8	NE	8.4	4.6	0.6
Mean ± SD		75.3 ± 11.2	0.582 ± 0.14	6.54 ± 0.73	3.64 ± 0.58	8.51 ± 0.37	3.17 ± 0.62	0.59 ± 0.32

*NE, not examined; BMD, bone mineral density.