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A Comparison of the Rate of Falls and Risk Factors between the Community-Dwelling Elderly Aged 65 to 74 and Those Aged 75 or over

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Abstract: We conducted a study in November 1995, on 746 subjects aged 65 or over in Koga in Ibaraki prefecture to identify differences in risk factors for falls between elderly aged 65 to 74 years (the young old) and those aged 75 or over (the old old). We employed a self-administered questionnaire to gather demographic data, information concerning the health status and regarding on falls during the previous 12 months.

There are 177 subjects (23.7% of the subjects) with a history of falls. The percentage of subjects with a history of falls in the old old is 27.01% is statistically significanly higher than that in the young old 21.80%. From the results of the multiple logistic regression analysis for the young old, it is found that urinary incontinence and hospitalization are significantly associated with a history of falls. These factors are therefore considered as risk factors for falls among the young old. Back pain and hospitalization are considered to be risk factors for falls among the old old as determined by the multiple logistic regression analysis. Extrapolating from the above, there appear to be differences in the risk factors for falls between the old old and young old.

INTRODUCTION

An increasing number of bedridden patients in Japan face problems such as serious physical disabilities and decline in the quality of life (QOL). Cerebrovascular disease was considered to be the leading cause of becoming bedridden in elderly patients, but recently the number of subjects becoming bedridden due to fall-related fractures has increased in Japan[1]. Also an increase in the number of fall-related hip fractures has been reported in epidemiological studies [2]

[3]. In many cases, falls resulted in incontinence and functional dependence, causing a deterioration in the physical health status of elderly subjects[4]. It is therefore necessary to reduce the risk of falls in the elderly in the community.

Falls are associated with many risk factors and a recognition of these risk factors is necessary to devise nursing care plan to prevent the elderly from falling. Nursing intervention of falls for the prevention is important for maintaining Activities of Daily Living (ADL), and QOL, and also for reducing the frequency of falls among the elderly. Nurses have studied falls mostly among the institutionalized elderly to identify fall-prone patients.[5][6][7][8][9][10] Although several epidemiological studies have been devoted to the study of falls among the elderly in the community[1][11][12][13], only a few studies on falls among the community-dwelling elderly have been carried out by medical care and social welfare providers in Japan. Recently, the subjects have provoked great interest among nurses because Japan is an aging society. It is therefore essential for nurses, and other medical professionals and family caregivers to conduct falls prevention programs primarily to decrease the incidence of injuries and impairment among the elderly in the community, in considerations of the situations and status of these patients after falls. Falls and fall-related injuries such as hip fractures often leads to marked changes in the health status of the elderly, especially those aged 75 years or older, and in most cases result in their becoming bedridden.

We predict that in the future the percentage of the elderly aged 75 years or over will be greatly increase in Japan, and that it will become 17% by the year 2000. Fall and fall-related deaths, and injuries from falls will also therefore grow. In order to control the number of disabled elderly, it is most important to reduce the risk of falling in the elderly who are 75 years or over. Morfitt[14] actually pointed out intrinsic risk factors for falling occur among the elderly 75 years old or over. The differences in risk factors between the young old and the old old are not clear. Therefore, it is the purpose of this study to identify the differences in risk factors for falls among the elderly 65 to 74 years old (the young old) and those 75 years old or over (the old old).

METHODS

Subjects: Koga is a local town located in the middle of the Kanto region in Japan, with a population of about 58,000, where the percentage of population aged 65 years or over is 10.5%.We had conducted " The Aging Research Project of Daily Living and Health status in Koga (ADK) " , and this study was started in collaboration with the public welfare office at Koga in Novem-

ber 1995. The subjects in the ADK study were randomized, and included 1,000 out of about 6,000 aged 65 years or over in Koga. In the event that the elderly could not answer the questions by themselves, their families were asked to answer for them. A total of 746 forms were completed and returned. We defined falls as, when the elderly fell unintentionally and his or her body touched the floor or ground. Out of the 1000 elderly subjects, 177 had a history of falls.

Methods: We employed a self-administered questionnaire to gather the following information: (1) demographic data and information concerning the health status of the subjects, (2) diagnosis and functional disabilities affecting their activities of daily living (ADL), (3) history of falls during the previous year, and (4) the thirteen-item index of competence (TMIG index) which was developed for measuring the activities of the elderly living in the community in Japan, in preference Instrumental Self-maintenance, Intellectual Activity and Social Role[15]. This self-administered questionnaire was mailed to each of the subjects to be completed and returned as soon as possible.

Satatistical Analysis: We analyzed the data concerning daily living and health status related to social services in collaboration with the public welfare office at Koga.The three statistical methods used were the chi-square test, odds ratio and the approximate 95% confidence intervals were for each variable. To select the independent variables of multiple logistic regression analysis, we analyzed the differences between the young old and the old old. In order to identify the risk factors for falls, we analyzed the history of falls as the dependent variable using the multiple logistic regression analysis. All analyses were performed using the Satatistical Analysis System (SAS) software version 6.08.

RESULTS

The percentage of valid response was 74.6% and the average age ± SD of the 746 subjects was 73.2±6.3. The percentage of the elderly aged 75 years or over was 58.0% and the percentage of females was 65.2%. There were 177 subjects (23.73% of the subjects) who gave a history falls. The falling percetageof subjects with a history of falls in the old old 27.01% was statistically significantly higher than that of the young old to 21.80%. The demographic data of the subjects is shown in Table 1. The percentage of subjects with history of in falling in the elderly aged 90 years or over was the highest and that in those aged between 65 and 69 was the lowest among all age groups. A comparison of disease history, functional disabilities, and ADL between the young old and the old old were revealed the following: Hypertension was the most

Table 1

The Incidence of Experienced Falls by Age and Sex

Age	Males	Females	Total
65-69	16.80(21/125)	22.22(30/135)	19.62(51/260)
70-74	23.26(20/ 86)	25.40(32/126)	24.53(52/212)
75-79	20.00(12/ 60)	31.46(28/ 89)	26.85(40/149)
80-84	12.50(4/ 32)	29.55(13/ 44)	22.37(17/ 76)
85-89	23.53(4/ 17)	36.84(7/ 19)	30.56(11/ 36)
90-	50.00(2/ 4)	44.44(4/ 9)	46.15(6/ 13)
Total	19.44(63/324)	27.01(114/422)	23.73(177/746)

*Percentage(the subjects who experienced falls/all subjects)

frequent diagnosis among the two groups (Table 2). The prevalence of rheumatoid arthritis among the old old was significantly higher than that among the young old. Compared to the young old, the old old had a significantly higher prevalence functional disabilities and problems of ADL ($p<0.05$).

The characteristics of the young old subjects with a history of fall and of those without are shown in Table 3. The highest odds ratios of the young old were urinary incontinence in all characteristics (OR=5.77). The following factors were related to falls: cerebrovascular disease, back pain, bedridden, limb impairments, urinary incontinence, hospitalization during the previous year and instrumental self-maintenance (TMIG Index) among the young old ($p<0.05$). As Table 4 indicates, the sex (eg. female), back pain, bedridden, vision impairment, limb impairments, urinary incontinence, and cognitive impairments were associated with falls among the old old ($p<0.05$).

In order to examine the importance of which of these constitute independent risk factors for falling, a multivariate logistic regression was conducted. Table 5 shows the results of the multiple logistic regression analysis among the young old. Independent variables in the logistic regression model were selected from the significant characteristics of the higher odds ratio. In the case of logistic regression analysis among the young old, cerebrovascular disease, limb impairment, urinary incontinence, back pain, cognitive impairment and instrumental self-maintenance in TMIG were selected as dependent variables. As Table 5 shows, urinary incontinence and hospitalization were considered as risk factors for falls among the young old in the analysis ($p<0.05$).

When compared with the young old, there were several significant factors in the old old. Thus, as the independent variables in the old old were selected nine significant characteristics.

Table 6 indicates that final results of multiple logistic regression analysis, and back pain (p<0.01)and hospitalization were identified as the risk factors among the old old (p<0.05).

Table 2

The Distribution of Diagnosis, Function, ADL between the Old Old and the Young Old

Number(%)

	Young old (n=472)		Old old (n=274)	Total (n=746)
Diagnosis				
Hypertension	178(37.71)		95(34.67)	273(36.60)
Heart disease	72(15.25)		50(18.25)	122(16.35)
Cerebro-vascular disease	42(8.90)		29(10.58)	71(9.52)
Diabetes	52(11.02)		20(7.30)	72(9.65)
Rheumatoid arthritics	24(5.08)	*	30(10.95)	54(7.24)
Respiratory disease	47(9.96)		27(9.85)	74(9.92)
Functions				
Vision impairment	16(3.39)	*	20(7.30)	36(4.83)
Hearing impairment	27(5.72)	**	42(15.33)	69(9.25)
Speech impairment	13(2.75)	**	11(4.01)	24(3.22)
Chewing impairment	58(12.29)	**	50(18.25)	108(14.48)
Limb impairment	41(8.69)	**	36(13.14)	77(10.32)
Urinary incontinence	22(4.66)	**	42(15.33)	64(8.58)
Cognitive impairment [1]	13(2.75)	**	29(10.53)	42(5.63)
Activities of Daily Living				
MOVING AND TRANSFER ACTION [2]				
Standing up and sitting down	5(1.06)	*	10(3.65)	15(2.01)
Walking in his or her house	3(0.64)	**	15(5.47)	18(2.41)
Walking in the neighborhood	8(1.69)	**	35(12.96)	43(5.80)
SELF CAREING [2]				
Feeding	1(0.21)	**	9(3.28)	10(1.34)
Dressing	5(1.06)	**	17(6.23)	22(2.95)
Getting in and off toilet	5(1.06)	*	12(4.38)	17(2.28)
Washing face	5(1.06)	*	3(4.74)	18(2.41)
Washing teeth or careing artificial teeth	3(0.64)	**	6(5.84)	19(2.55)
Bathing	10(2.12)	**	24(8.79)	34(4.57)

1)Cognitive impairment was considered present if the subject made at least one or more errors on 5 short questionnaire by family.

2)with help/unable * p<0.05, **p<0.01

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Table 3

**The Distribution of Diagnosis, Function, TMG Index
among the young old Who did/did not experience falls**

Number(%)

Characteristics	Fell (n=103)	Did Not Fall (n=369)	χ^2test	Odds Ratio	95%CI
Diagnosis or Symptoms					
Cerebrovascular disease	16(15.53)	26(7.05)	p<0.05	2.43	1.24-4.73
Back pain	51(49.51)	132(72.10)	p<0.05	1.76	1.13-2.74
Being bedridden	17(16.50)	28(62.22)	p<0.001	5.77	2.40-13.94
Functions					
Limb impairment	19(18.45)	22(5.96)	p<0.001	3.57	1.85- 6.89
Urinary incontinence	13(12.62)	9(2.44)	p<0.001	5.77	2.40-13.94
Hospitalization during past year	25(24.27)	42(11.38)	p<0.001	2.49	1.43- 4.34
TMIG Index					
Instrumental Self-maintenance					
4-5	86(83.50)	345(93.49)			
2-3	8(7.77)	15(4.06)		2.14	0.88- 5.21
0-1	9(8.73)	9(2.43)	p<0.05	4.01	1.55-10.41
Intellectual Activity					
3-4	74(71.84)	313(84.82)			1.00 -
0-2	29(28.15)	56(15.18)	p<0.05	2.19	1.31-3.67
Social Role					
3-4	80(77.66)	329(89.16)			1.00 -
0-2	23(22.34)	40(10.84)	p<0.05	2.37	1.34-4.17

· The numbers of people who fell(Percentages=the subjects who experienced falls/all subjects).

Table 4

The Distribution of Diagnosis, Function, TMG Index
among the old old who did/did not experience falls

Number(%)

Characteristics	Fell (n=74)	Did Not Fall (n=200)	χ^2test	Odds Ratio	95%CI
Sex (female)	52(70.27)	109(54.50)	p<0.05	1.97	1.11-3.50
Back pain	50(67.57)	65(32.50)	p<0.01	4.33	2.45-7.65
Being bedridden	27(36.49)	36(18.00)	p<0.01	2.62	1.44- 4.75
Vision impairment	11(14.86)	9(4.50)	p<0.05	3.71	1.47-9.35
Limb impairment	17(22.97)	19(9.50)	p<0.001	2.84	1.38- 5.83
Urinary incontinence	22(29.72)	20(10.00)	p<0.001	3.81	1.93- 7.51
Cognitive impairment	15(20.27)	14(10.00)	p<0.01	3.38	1.54- 7.41
Hospitalization during past year	24(32.43)	30(15.00)	p<0.01	2.72	1.46- 5.07
TMIG Index					
Instrumental Self-maintenance					
4-5	34(45.50)	149(74.50)			
2-3	17(22.97)	26(13.00)	p<0.01	2.87	1.40- 5.86
0-1	23(31.08)	25(12.50)	p<0.001	4.03	2.05- 7.94
Intellectual Activity					
3-4	37(50.00)	141(70.50)			1.00 -
0-2	37(50.00)	59(29.50)	p<0.01	2.39	1.38-4.13
Social Role					
3-4	38(51.35)	142(71.00)		1.00 -	
0-2	36(48.65)	58(29.00)	p<0.01	2.31	1.34-4.02

· The numbers of people who fell(Percentages=the subjects who experienced falls/all subjects).

Table 5

Risk Factor for Falls (dependent variable)[a] by the Young Old

Number(%)

Risk factor (Independent variable)	Parameter estimate	Standard error	Odds ratio	95%CI
• Cerebro-vascular disease [b]	0.21	0.40	1.23	0.56-2.70
• Back pain	0.38	0.23	1.47	0.93-2.30
• Limb impairment [b]	0.63	0.40	1.87	0.85-4.11
• Urinary incontinence	1.19*	0.50	3.29	1.23-8.76
• Being bedridden	0.25	0.40	1.28	0.58-2.81
• Hospitalization during the past year [b]	0.71*	0.30	5.49	1.13-3.66
• Instrumental Self-maintenance [c]	-0.09	0.12	0.92	0.72-1.16

a)Dependent variable was the subjects who fell(n=103)=1、did not fall(n=369)=0.

b)Yes=1、No=0,

c)Estimated by a 5 degree scale.　5=independent,0=unable(totally dependent).

activity.　*　p<0.05

Table 6

Risk Factor for Falls (dependent variable)[a] by the Old Old

Risk factor (Independent variable)	Parameter estimate	Standard error	Odds ratio	95%CI
• sex(females) [b]	0.52	0.33	1.69	0.88-3.21
• Back pain [c]	1.25**	0.32	3.48	1.86-6.53
• Limb impairment	0.24	0.46	1.27	0.52-3.14
• Urinary incontinence	0.63	0.43	1.90	0.80-4.36
• Vision impairment	0.86	0.54	2.36	0.82-6.81
• Hospitalization during the past year	0.77*	0.37	2.17	1.05-4.46
• Being bedridden	-0.13	0.43	0.87	0.38-2.04
• Cognitive impairment	0.64	0.50	1.90	0.71-5.05
• Instrumental Self-maintenance [d]	-0.16	0.10	0.85	0.70-1.03

a)Dependent variable was the subjects who fell(n=74)=1、 did not fall(n=200)=0.
b)males=0,females=1
c)Yes=1、 No=0,
d)Estimated on a 5 degree scale.5=independent, 0=unable(totally independent).
 activity.
 *   p<0.05   ** p<0.01

DISCUSSION

   Recently the number of elderly people in the world has grown at an unprecedented rate. The percentage increases in the elderly population in Japan is the highest in the word, a natural result of fewer births and deaths. According to a statistical survey, the percentage of old old was 5.7% (the percentage of elderly 65 years old or over is 14.5%) in 1995 and it has been predicted that the rate will be 15.6% (the percentage of elderly 65 years old or over will increase to 27.4%) in future. We compared the risk factors for falls and injuries suffered due to falls among the young old and the old old, since the percentage of Japanese, 75 years old and over is increasing at a remarkable rate compared to at of subjects 65 years old and over.

   According to the rate of fall in this study, 23.7% of the subjects had a history of fall within the previous year. Prudham & Evans[16] , Cambell, et al.[12] and Blake, et al.[17] reported that the rates of falls was 20-40%, but the rate in the ADK study and other Japanese studies[1][13] was lower than that in Western studies. Although the incidence of fractures among Caucasian women was higher than that among Japanese women, the average bone mineral mass in Caucasian women was higher than that in Japanese women [18][19] . These results indicate, the number of the fractures caused by falls is great and, that Westerners fall more often[20] . It is possible that this is

related with the life style of westerns, their dwelling environment, their physique, etc.

In the results of multiple regression analysis, hospitalization was a risk factor for falls in each group. Tinetti [11] reported that hospitalization in the previous year was significantly related to falls in the elderly 70 years old or over. It seems reasonable to suppose that falls are related to the presence of diseases or impairments and that, elderly sick have an increased risk of falling. Tinetti [11] repeated that hospitalized in past year was significantly related to falls. According to studies in geriatric units, elderly patients have a relatively high frequency of falls. In addition, when the elderly are hospitalized for long periods of time, body muscle mass is likely to be reduced due to bed rest or restriction of physical activity. It is necessary that public health nurses conduct fall prevention programs for the elderly with a history of hospitalization in the previous year.

Comparison of the two groups revealed that another risk factor in the young old was urinary incontinence, an important geriatric symptom. Urinary incontinence is one of the preventable symptoms among the elderly, and is a compound risk factor involving physical, psychosocial and environmental factors. Incontinence among the young old, in particular, seems to be caused by other physical disabilities such as neurological problems or decline in pelvic muscular activity. These causes might be related to falls because of the associated urinary incontinence. Although urinary incontinence is a risk factor among the young old in this study, Tinetti et al. [4,11] reported that urinary incontinence was a risk factor for falls among all elderly. The young old who have incontinence also seem to have other serious problems such as being bedridden. Thus, urinary incontinence is a significant as an important risk factor for falls in this study. In the case of Japanese bedridden, the order of the importance is like this, urinary incontinence, cognitive impairments and falling [21]. Nurses have to assess carefully whether or not community-dwelling elderly patients have a combination of these problems.

In the results among the old old, another risk factor was back pain; this seems to be one of the symptoms of osteoporosis among the elderly. Osteoporosis occurs as a result of calcium loss and is related to age, and there is greater likelihood of severe or continued pain associated with the fractures going unnoticed. These physical situations due to osteoporosis facilitate falls among the elderly. Although these symptoms are present among the old old, they seem to be related to postural instability and a limited visual field. There are several differences among risk factors in the young old and old old because the physical changes of aging are related to falls. The sense of balance and sight get worse with aging, the symptoms of degeneration related to falls.

Tinetti, et al. [22] also reported a fear of falls among the elderly, and he found that the elderly tend to have fear after falls and their decline in ADL was related to their fear of falls. The old old

are influenced somehow physically and mentally, whether or not they are injured by the falls. Our research did not consider any mental problems, but they are important because the fear of falls is related to the limitation of activities. We consider that Japanese bedridden patients and house-bound elderly, are influenced by their fall experiences, and further studies may be needed to clarify this relationship.

Cognitive impairment and limb impairment were not identified as risk factors for falling in the final results. Both cognitive and limb impairments were reported as risk factors for falling in previous studies [11], especially serious cognitive impairment such as senile dementia was discussed as an important of risk factor in the previous study[23][24] . It is clear that we must consider these factors as risk factors as falling in relation to nursing practices for prevention of falls.

There are several problems related to being bedridden such as being house-bound and other the disabilities among elderly patients. Falls are common in the community, but it is reasonable to suppose that identification risk factors for falling would help public health services in reducing the health problems facing the bedridden elderly. It would be practical to consider these factors in falls prevention programs for the elderly in not only the hospital but also in the community.

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