Concomitant hip and upper extremity fracture in elderly patients: Prevalence and clinical implications

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A B S T R A C T

Background: Hip fracture and upper extremity fracture are most important age-related fracture. However, there have been few reports about the analysis of prevalence or risk factors with concomitant hip and upper extremity fractures. This study aimed to describe the prevalence and clinical implications of the concomitant hip and upper extremity fractures in elderly.
Methods: We evaluate 1018 patients aged >65 years who were surgically treated for femoral neck or intertrochanteric fractures between March 2008 and December 2018. 35 patients (3.4%) with a hip fracture combined upper extremity fracture. All patients were classified into the isolated hip fracture and the concomitant fracture. We analyzed these patients' characteristics such as age, gender, bone mineral density (BMD), body mass index (BMI), Korean version of Mini-Mental State Examination (MMSE-K), injury mechanism, and length of hospital stay.
Results: The most common site of upper extremity fracture was distal radius fracture of 15 patients (42.8%), followed by proximal humeral fracture of 8 (22.8%). Concomitant fractures occurred on the same side in 30 patients (85.7%). The mean age of patients with a concomitant fracture was younger than that of patients with an isolated hip fracture (p < 0.05). Mean preinjury MMSE-K was 22.7 in isolated hip fracture and 25.6 in concomitant fracture patients (p < 0.05). Mean length of hospital stay was statistically significant different between two groups (p < 0.05). According to fracture site of hip, there was no statistically different prevalence of upper extremity fracture in femoral intertrochanteric fracture compared to the neck fracture.
Conclusion: We found a 3.4% prevalence of concomitant hip and upper extremity fractures. It was found that the younger the age with preserved cognitive ability in elderly patients with a hip fracture, the higher the prevalence of upper extremity fracture. In addition, it is important to keep in mind that patients with a concomitant fracture have a longer hospital stay and difficulty in rehabilitation.

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Introduction

Hip fractures are increasing rapidly due to aging of the population and are very high mortality rates within one year of operation [1,2]. Especially, these fractures are more frequent in osteoporosis patients with weak bone quality [3,4]. In osteoporotic elderly fractures, following hip fracture, the next common fractures is upper extremity fractures [5]. Although these fractures occur in elderly patients with different mechanism, it is expected to delay rehabilitation for walking if both fractures occur at the same time. Furthermore, additional treatment may result in increased mortality and morbidity due to the difficulty of the treatment process [6,7]. To date, there have been many studies on the outcome and prognosis of hip fracture and upper extremity in elderly patients. But there are limited studies on concomitant hip fracture and upper extremity fracture. In addition, studies on the factors affecting the association of both fractures and the outcome of treatment are very poor. It is not known how many hip fractures and upper extremity fractures occur at the same time, but it is reported to be approximately 3.6%–6.5% [6,8,9].

The aim of this research paper is to investigate the prevalence and characteristics of patients with concomitant hip and upper extremity fracture. And, we would like to identify the factors associated with these fractures and evaluate their clinical implications.

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Table 1
Type and number of upper extremity fracture in patients with combined hip fracture.

Site of injury	Number (%)	Ipsilateral injuries (%)	Operation (%)
Acromioclavicular dislocation	1	0	0
Clavicle fracture	3	2	2
Proximal humeral fracture	8	7	4
Distal humeral fracture	5	5	2
Radial head fracture	1	1	0
Distal radius fracture	15	13	9
Metacarpal fracture	1	1	0
Phalanx fracture	1	1	0
Total	35	30	17

Materials and methods

This study followed the World Medical Association Declaration of Helsinki guidelines. Patient information was reviewed by the university human subjects committee, and final approval of informed consent exemption by the institutional review board was obtained. A retrospective cohort study analyzed a consecutive series of patients with a hip fracture who underwent surgical treatment between January 2008 and January 2018. The exclusion criteria were high-energy related hip fractures such as femoral head fracture, pelvis fracture, and subtrochanteric fracture. We also excluded pathologic fracture, neoplasia, and patients under 65 years of age. We included patients with fragility hip fractures: femoral neck fracture and intertrochanteric fracture. After exclusion, 1018 patients over 65 years of age with a hip fracture remained. The patients were divided into two groups according to the presence of upper extremity fracture, and we compared age, gender, BMD, preinjury MMSE-K (Korean version of Mini-Mental State Examination), injury mechanism, treatment and duration of stay in hospital between the two groups. Hip fractures were reclassified as femoral neck fracture and intertrochanteric fracture, and compared between the two groups. A low-energy trauma fracture was defined as a fracture caused by an injury equal to or less than fall at standing height [10].

In principle, we performed internal fixation using proximal femoral nail as quickly as possible within 48 h of hospital admission in patients over 65 years of age with intertrochanteric femoral fractures. Patients with a femoral neck fracture were treated with internal fixation using cannulated screws in the Garden stage I or II, and with hip arthroplasty in the displaced fracture. Postoperatively, all patients were prescribed low molecular weight heparin as thromboprophylaxis. Patients were instructed to walk with partial weight-bearing with the aid of crutches or walker on the second day, with full weight-bearing as tolerated in isolated hip fracture. Brace assisted ambulation was not possible in patients with a concomitant fracture. Therefore, these patients began with range of motion exercise and quadriceps strengthening exercise in bedside. Six weeks after the operation, weight bearing ambulation was initiated. There was a difference in the rehabilitation process between the two groups.

Statistical analysis

Summary data are expressed as means ± standard deviation for continuous variables and number and frequencies (%) for categorical ones. Continuous variables with abnormal distribution were analyzed using the Mann-Whitney U test. Independent t-tests were used to compare variables with a normal distribution. Categorical data were statistically analyzed by chi-square test or Fisher's exact test (n <40 or t <1). Significant difference was considered present with a two-sided p-value less than 0.05. Statistical analysis was performed using SPSS software, version 20.0 (SPSS Inc., Chicago, Illinois, USA).

Table 2
Comparison of characteristics between patients with isolated hip fractures and those with concomitant fractures.

	Isolated hip fractures	Concomitant fractures	p-value
No.	983	35	
Age (years)	79.3 ± 7.1	75.9 ± 5.4	0.001
BMD (T-score)	−2.8 ± 1.0	−2.7 ± 1.1	0.481
BMI (kg/m^2)	21.7 ± 3.5	21.5 ± 3.7	0.745
MMSE-K	22.7 ± 5.4	25.6 ± 4.2	0.010
Female:Male	1.7:1	2.1:1	0.578
Injury ratio (high:low)	5.4.1	6:1	0.837
Stay of hospital (day)	15.9 ± 4.9	19.8 ± 6.7	0.024

Data displayed using means ± SD.
BMD = body mass index, BMD = bone mineral density, MMSE-K = Korean version of Mini-Mental State Examination.

Results

Of the 1018 patients, 35 patients (3.4%) had concomitant upper extremity fractures. The most common site of upper extremity fracture was distal radius fracture of 15 patients (42.8%), followed by proximal humeral fracture of 8 (22.8%). Concomitant fractures occurred on the same side in 30 patients (85.7%) (Table 1). Seventeen patients (48.5%) underwent surgical treatment for upper extremity fractures. In comparison between the two groups according to the presence of upper extremity fracture, the mean patient's age was 79.3 years (range, 65–93 years) in isolated hip fractures and 75.9 years (range, 65–89 years) in concomitant fractures (p = 0.001). The mean MMSE-K score was 22.7 (range, 19–26) in isolated hip fracture and 25.6 (range, 17–25) in concomitant fractures (p = 0.010). There was no significant difference in demographic parameters in terms of T-score of BMD, BMI, female to male ratio, and high energy injury to low energy injury ratio between both groups (Table 2). However, the mean duration of hospital stay was 15.9 days (range, 4–22 days) in isolated hip fractures and 19.8 days (range, 12–39 days) in concomitant fracture patients (p = 0.024).

Hip fractures included 478 (47.0%) femoral neck fractures and 540 (53.0%) femoral intertrochanteric fractures. Of the 478 patients with a femoral neck fracture, 11 patients (2.3%) had upper extremity fractures. Of the 540 patients with an intertrochanteric fracture, 24 patients (4.4%) had upper extremity fractures. In femoral neck fracture group, the mean age, BMD, BMI, MMSE-K, sex, and ratio of high energy between isolated hip fractures and concomitant fractures did not differ statistically. However, the mean duration of hospital in hospital was 16.7 days in isolated hip fractures and 23.4 days in concomitant fractures, and there was a statistically significant difference (p < 0.001). In femoral intertrochanteric fracture group, the mean age was 80.7 years (range, 65–92 years) in isolated hip fractures and 76.0 years (range, 65–89years) in combined fractures (p = 0.002). The mean T-score of BMD was −3.0 (range, −0.2 to −4.8) in isolated hip fractures and

-2.5 in concomitant fractures patients (p = 0.044). The mean MMSE-K score was 22.5 (range, 17–25) in isolated hip fractures and 25.8 (range, 19–26) in concomitant fractures, and there was a statistically significant difference (p = 0.012). Furthermore, the mean duration of hospital stay was 15.2 days (range, 4–22 days) in isolated hip fractures and 18.2 days (range, 12–39 days) in concomitant fractures (p = 0.003). In femoral intertrochanteric fracture group, the mean BMI, sex, and ratio of high energy between isolated hip fractures and concomitant fractures did not differ statistically (Table 3).

Discussion

There are several researches on hip fractures and upper extremity fractures with increasing hip fractures. Robinson et al. found 3.6% patients with hip fracture had an upper extremity fracture over 60 year-old patients [8]. Mulhall et al. found 36 patients with simultaneous upper extremity fractures out of 760 total patients admitted with hip fractures (4.7%) [6]. Thayer et al. found that 6.5% patients aged 65–100 with a low energy hip fracture sustained a simultaneous upper extremity injury [9]. Thayer et al. commented that previous study may have unintentionally selected a patient population with less severe injuries, leading to an underestimated of co-injury [9]. But, they introduced some selection bias and may represent a more injured population. Furthermore, there were patients at different institutions. Our results showed 3.4% patients with concomitant hip and upper extremity fractures. Our study is a retrospective study but, all of data was collected prospectively in a single institute. Furthermore, this hospital is the only public general tertiary hospital in this area.

Upper extremity fractures occurring at the same time as hip fractures were mainly distal radius fracture and proximal humeral fracture [6,8,9]. In our study, distal radius fractures were the most common (42.8%), followed by proximal humeral fractures (22.8%). This is generally consistent with the part where upper extremity fractures occur [11]. This is probably due to fractures caused by osteoporosis about old ages. Both hip fracture and upper extremity fracture are the representative fractures of the elderly, and most of the fractures are in the process of falling.

Uzoigwe et al. in 2013 evaluated 88 patients with hip and distal radius fractures and compared them to 772 patients with isolated hip fractures [12]. They found a longer length of hospital stay in the multiply injured group (18 vs 13 days, p < 0.001). Other studies have also reported longer hospital stay in patients with combined hip and upper extremity fractures. The same results were obtained in our study. The mean duration of hospital stay was 19.8 days in concomitant fractures, it took an average of 4 more days. Shabat et al. found that 60.1% of patients were discharged to a rehabilitation facility [7]. As with other studies, our study did not analyze how many patients were treated in post-discharge

rehabilitation hospitals. However, in the experience of the authors, the upper extremity fracture delayed the rehabilitation process, leading to an extension of the hospital stay. Because of the difficulty of regular follow-up observation because of the tertiary hospital and elderly patients, it was not possible to evaluate the rehabilitation process after the rehabilitation hospital.

Mulhall et al. found that the female to male ratio in the isolated hip fracture group was 3:1 and for the combined fractures group it was 8:1 (p = 0.014) [6]. Also Robinson et al. reported that the female to male ratio was much higher in simultaneous wrist and hip fractures compared to solitary hip fractures (6:1 vs 3:1) [8]. In our study, there was not a statistically significant difference in the female to male ratio between the two groups, although the female ratio was high in numerical terms. More research is needed to conclude that the risk of concomitant upper extremity fracture is higher in female with a hip fracture.

Tow et al. in 2009 performed a retrospective review on 33 patients admitted for hip and upper extremity injuries [13]. They found that an average age for hip and upper extremity fracture patients of 79.5 years, similar age with hip fracture alone. Also Thayer et al. reported similar results about age. However, Mulhall et al. found that the mean patient age was 77.3 years for the isolated hip fracture group, and 83.9 for the combined group (p = 0.037) [6]. In our study, the mean patient's age was 79.3 years for isolated hip fractures and 75.9 for the concomitant fracture. Unlike previous studies, there were more upper extremity fractures in relatively younger patients in our study. Furthermore, the mean MMSE-K score was higher in concomitant fractures than isolated hip fractures. O'Neil et al. found that compared with older women, women under age 65 were more likely to fall onto their hand [14]. And they commented that patients of concomitant fractures had a significantly better mean mental score compared with solitary hip fractures (7.1 vs. 6.3 p = 0.040). In those patients with a wrist fracture the better general health may mean that patients have better protective reflexes when falling. These findings would suggest that patients with combined fracture are more likely to be younger. Because of this age difference, it is concluded that BMD are low especially in combined fracture patients with trochanter fracture. In other words, the results of this study showed that cognitive ability, younger than the age of the elderly, is associated with upper extremity fracture.

This study has several limitations. First, this was a single-center retrospective cohort study. However, we account for all pre- and postoperative outcomes in our consecutive patients. Second, we could not analyze for the postoperative mortality and results during rehabilitation period. Third, this study lacked consistency in terms of the type of implant used during surgery at each fracture. Finally, this study did not include the association with co-morbidities. Further studies may consider analyzing if there is a relationship between concomitant fractures and co-morbidities.

Table 3
Comparative data between femoral neck and trochanter fractures.

	Femoral neck fracture			Trochanter fracture		
	Isolated hip fracture	Concomitant fracture	*p*-value	Isolated hip fracture	Concomitant fracture	*p*-value
No.	467	11		516	24	
Age (year)	77.8 ± 6.4	75.4 ± 4.9	0.227	80.7 ± 7.4	76.0 ± 5.6	0.002
BMD (T-score)	−2.6 ± 0.9	−3.0 ± 1.3	0.166	−3.0 ± 1.1	−2.5 ± 1.0	0.044
BMI (kg/m²)	21.9 ± 3.5	20.6 ± 3.9	0.249	21.6 ± 3.5	21.9 ± 3.6	0.625
MMSE-K	24.8 ± 4.1	25.4 ± 2.5	0.826	22.5 ± 3.5	25.8 ± 2.3	0.012
Female:Male	2.3:1	4.5:1	0.397	1.4:1	1.6:1	0.699
Injury ratio (high:low)	6.7:1	11:0	0.204	4.54:1	3.8:1	0.727
Stay of hospital (day)	16.7 ± 4.9	23.4 ± 8.9	0.000	15.2 ± 4.7	18.2 ± 4.8	0.003

Data displayed using means ± SD.
BMD = body mass index, BMD = bone mineral density, MMSE-K = Korean version of Mini-Mental State Examination.

These limitations are obvious obstacles to the generalization of our results; thus, further multicenter prospective studies are required to verify their authenticity.

Conclusion

We found a 3.4% prevalence of concomitant hip and upper extremity fractures. This is not a relatively small number and will gradually increase with aging. It was found that the younger the age with preserved cognitive ability in elderly patients with a hip fracture, the higher the prevalence of upper extremity fracture. In addition, it is important to keep in mind that patients with these concomitant fractures have a longer hospital stay and difficulty in rehabilitation.

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Declaration of Competing Interest

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References

[1] Gallagher JC, Melton LJ, Riggs BL, Bergstrath E. Epidemiology of fractures of the proximal femur in Rochester, Minnesota. Clin Orthop Relat Res 1980;163–71.

[2] Lunde A, Tell GS, Pedersen AB, Scheike TH, Apalset EM, Ehrenstein V, et al. The role of comorbidity in mortality after hip fracture: a nationwide norwegian study of 38,126 women with hip fracture matched to a general-population comparison cohort. Am J Epidemiol 2019;188:398–407.

[3] Yoon HK, Park C, Jang S, Jang S, Lee YK, Ha YC. Incidence and mortality following hip fracture in Korea. J Korean Med Sci 2011;26:1087–92.

[4] Schurer C, Wallaschofski H, Nauck M, Volzke H, Schober HC, Hannemann A. Fracture risk and risk factors for osteoporosis. Dtsch Arztebl Int 2015;112:365–71.

[5] Biber R, Gruninger S, Bail HJ. Upper extremity fractures in the elderly. Z Gerontol Geriatr 2017;50:73–85.

[6] Mulhall KJ, Ahmed A, Khan Y, Masterson E. Simultaneous hip and upper limb fracture in the elderly: incidence, features and management considerations. Injury 2002;33:29–31.

[7] Shabat S, Gepstein R, Mann G, Stern A, Nyska M. Simultaneous distal radius and hip fractures in elderly patients–implications to rehabilitation. Disabil Rehabil 2003;25:823–6.

[8] Robinson PM, Harrison T, Cook A, Parker MJ. Orthopaedic injuries associated with hip fractures in those aged over 60 years: a study of patterns of injury and outcomes for 1971 patients. Injury 2012;43:1131–4.

[9] Thayer MK, Kleweno CP, Lyons VH, Taitsman LA. Concomitant upper extremity fracture worsens outcomes in elderly patients with hip fracture. Geriatr Orthop Surg Rehabil 2018;9:2151459318776101.

[10] Lin WP, Wen CJ, Jiang CC, Hou SM, Chen CY, Lin J. Risk factors for hip fracture sites and mortality in older adults. J Trauma 2011;71:191–7.

[11] Lubbeke A, Stern R, Grab B, Herrmann F, Michel JP, Hoffmeyer P. Upper extremity fractures in the elderly: consequences on utilization of rehabilitation care. Aging Clin Exp Res 2005;17:276–80.

[12] Uzoigwe CE, Venkatesan M, Johnson N, Lee K, Magaji S, Cutler L. Influence of coincident distal radius fracture in patients with hip fracture: single-centre series and meta-analysis. J Orthop Traumatol 2015;16:93–7.

[13] Tow BP, Chua BS, Fook-Chong S, Howe TS. Concurrent fractures of the hip and wrist: a matched analysis of elderly patients. Injury 2009;40:385–7.

[14] O'Neill TW, Varlow J, Silman AJ, Reeve J, Reid DM, Todd C, et al. Age and sex influences on fall characteristics. Ann Rheum Dis 1994;53:773–5.