ORIGINAL ARTICLE

Risk Factors of Distal Radius Fracture in Elderly Thai Population

Chalat Jaruwan, MD[1], Pongsathorn Sitthisen, MD[1], Waricha Eaimjinnasuwat, MD[2], Thanakorn Jongjaid, MD[3], Thossart Harnroongroj, MD[4]

[1] Department of Orthopedic Surgery, Ratchaphiphat Hospital, Bangkok, Thailand; [2] Department of Geriatric Medicine, Ratchaphiphat Hospital, Bangkok, Thailand; [3] Department of Community Medicine, Ratchaphiphat Hospital, Bangkok, Thailand; [4] Department of Orthopedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

Background: Advances in medical technology have increased the life expectancy of the elderly population, leading to a higher proportion of elderly people in the healthcare system. As people grow older, their organ systems, including the musculoskeletal system, degenerate. This degeneration, including decreased muscle mass, reduced bone mass, and poor body balance, increases the risk of falls and fractures. Distal radius fractures are the second most common fractures in the elderly, following hip fractures.

Objective: To investigate risk factors for low-energy distal radius fractures in the elderly in Bang Khae District.

Materials and Methods: The retrospective study included patients aged 60 years and older with distal radius fractures due to low-energy trauma, residing in Bang Khae District. Data was collected between January 1, 2018, and December 31, 2022. Eighty patients met the inclusion criteria, with 60 patients in the fracture group and 20 patients in the no-fracture group. The comparison focused on identifying risk factors between the two groups.

Results: The risk of distal radius fracture was higher in females (OR 4.17, 95% CI 1.25 to 17.72, p=0.022). Protective factors included calcium intake (OR 0.06, 95% CI 0.01 to 0.34, p=0.001) and vitamin D intake (OR 0.03, 95% CI 0.00 to 0.28, p=0.002). No significant risk factors were found for surgical treatment and malunion.

Conclusion: Elderly female patients have a higher risk of distal radius fractures compared to males. The intake of calcium and vitamin D seem to be protective factors against distal radius fractures in the elderly.

Keywords: Elderly; Distal radius fracture; Low energy trauma; Risk factors

Received 17 September 2024 | Revised 5 March 2025 | Accepted 18 March 2025

J Med Assoc Thai 2025;108(4):298-303

Website: http://www.jmatonline.com

Advancements in medical technology have significantly increased life expectancy, leading to an aging society worldwide[1]. The increasing elderly population has also resulted in a rise in the number of elderly patients within the healthcare system. Aging is associated with the degeneration or decline in the function of many organ systems. Deterioration in the musculoskeletal system includes conditions such as decreased muscle mass, decreased bone mass, and poor balance. These conditions increase the risk of falls and subsequent fractures from minor trauma[2].

Correspondence to:

Jaruwan C.
Ratchaphiphat Hospital, Bangkok 10160, Thailand.
Phone: +66-2-1024222, +66-2-4212222
Email: dr.chalat@gmail.com

How to cite this article:

Jaruwan C, Sitthisen P, Eaimjinnasuwat W, Jongjaid T, Harnroongroj T. Risk Factors of Distal Radius Fracture in Elderly Thai Population. J Med Assoc Thai 2025;108:298-303.
DOI: 10.35755/jmedassocthai.2025.4.298-303-01773

Additionally, the elderly tend to be more active and show increased independence, which increases their risk of falls and fractures at various sites such as the wrist, hip, spine, humerus, and ankle[3]. Distal radius fractures are the second most common fractures in the elderly, following hip fractures, and are the most frequent upper extremity fractures[4,5]. The global incidence of distal radius fractures ranges from 9 to 22.8 cases per 1,000 person-years[6]. These fractures account for 18% of all fractures in the elderly[7]. Distal radius fractures typically result from low-energy trauma, such as falling from standing height or less[8].

Treatment can be either conservative management or surgical management. The steps involved in these treatments impact patients, caregivers, and healthcare budgets. Until the fracture heals, patients' ability to perform self-care and other tasks is limited, reducing their overall activities[5]. If complications occur, such as stiffness, complex regional pain syndrome, malunion, or delayed union, the time needed to return

to normal activities could be significantly prolonged. If the incidence of distal radius fractures in the elderly could be reduced, the quality of life for patients and caregivers would improve, and healthcare budgets also decreased. The present study aimed to investigate the risk factors for low-energy distal radius fractures in the elderly, residing in Bang Khae District, an area with a large elderly population.

Materials and Methods

Patients and study design

The present study was a retrospective data collection from medical records at a secondary hospital in Bangkok. After receiving ethical approval (COA No. S002h/66_EXP), data was collected from a single hospital for elderly patients aged 60 years and older who resided in Bang Khae District and visited the hospital due to minor falls between January 1, 2018, and December 31, 2022. The inclusion criteria were elderly patients aged 60 years and older residing in Bang Khae District. The exclusion criteria included incomplete medical records, injuries caused by other than minor falls such as physical assault or traffic accidents, associated with other injuries such as hip fractures, head injuries, tendon tears, lacerations/open wounds, or neurovascular injuries, fractures from pathological conditions, open fractures, non-Thai ethnicity to minimize confounding effects from genetic and lifestyle differences, use of estrogen hormones due to their adverse impact on bone health, and use of steroids due to their adverse impact on bone health. All data that met the inclusion criteria and did not meet the exclusion criteria were included in the present study.

Outcomes were identified as presence of fractures, surgical treatment, and malunion. Risk factors included gender, age, body mass index (BMI), season of injury defined as winter, summer, and rainy, which were classified by the announcement of the Thai Meteorological Department, timing of injury defined as day and night, comorbidities such as diabetes mellitus (DM), rheumatoid arthritis (RA), and chronic kidney disease (CKD), electrolyte imbalance, smoking, alcohol consumption, calcium intake, and vitamin D intake.

Statistical analysis

Quantitative data, such as age and BMI, were presented as mean and standard deviation. Qualitative data, such as gender, comorbidities, smoking, alcohol consumption, season and time of injury, calcium intake, and vitamin D intake were presented as numbers and percentages. Categorical data were analyzed using Pearson's chi-square or Fisher's exact test. Continuous data were analyzed using independent t-test. Sample size was calculated. Risk factors for distal radius fractures in the elderly were analyzed by dividing the participants into two groups as those with distal radius fractures and those without. Factors associated with surgical treatment were analyzed by dividing patients with distal radius fractures into two groups as those who received surgical treatment and those who did not. Factors associated with malunion were analyzed by dividing patients with distal radius fractures into two groups as those with malunion and those without. Multivariate logistic regression was used to analyze the significant risk factors and control for confounders.

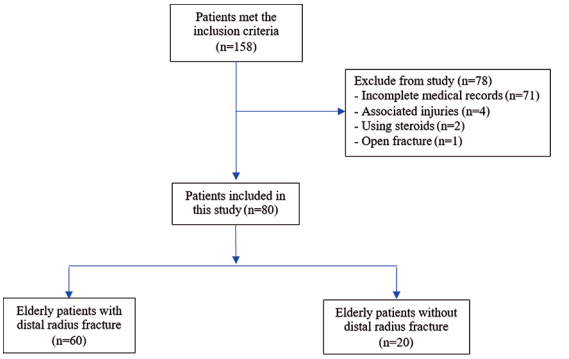

Figure 1. Patients flow chart illustrating the inclusion and exclusion process. A total of 158 patients were initially screened. Seventy-eight patients were excluded for specific reasons: incomplete medical records (n=71), associated injuries such as hip fractures or head injuries (n=4), use of steroids (n=2), and open fractures (n=1). The remaining 80 patients were included in the final analysis.

Results

One hundred fifty-eight elderly patients met the inclusion criteria. From this group, 71 had incomplete medical records, four had associated injuries, two were using steroids, and one had an open fracture. This left 80 patients eligible for the present study, with 60 elderly patients (75%) had distal radius fractures and 20 elderly patients (25%) had not, as shown in Figure 1.

The mean age of patients was 70.03±7.34 years and 72.95±7.98 years in the elderly with and without distal radius fractures, respectively. There were significant differences between the two groups in terms of gender, calcium intake, and vitamin D intake. The proportion of females was 91.67% and 70.0% (p=0.024), calcium intake was 3.33% and

Table 1. Demographic data and risk factors of patients compared between distal radius fractures and no fracture group

Variable	Fracture (n=60)	No fracture (n=20)	p-value
Age (years); mean±SD	70.03±7.34	72.95±7.98	0.136
Gender; n (%)			0.024
Female	55 (91.67)	14 (70.00)	
Male	5 (8.33)	6 (30.00)	
BMI; mean±SD	24.02±3.96	24.76±5.69	0.523
DM; n (%)	14 (23.33)	8 (40.00)	0.148
RA; n (%)	1 (1.67)	2 (10.00)	0.153
CKD; n (%)	11 (18.33)	4 (20.00)	1
Electrolyte imbalance; n (%)	11 (18.33)	5 (25.00)	0.530
Smoking; n (%)	2 (3.33)	0 (0.00)	1
Alcohol consumption; n (%)	1 (1.67)	0 (0.00)	1
Season; n (%)			0.989
Winter	19 (31.67)	6 (30.00)	
Summer	12 (20.0)	4 (20.00)	
Rainy	29 (48.33)	10 (50.00)	
Time; n (%)			0.064
Day	46 (76.67)	11 (55.00)	
Night	14 (23.33)	9 (45.00)	
Calcium; n (%)	2 (3.33)	7 (35.00)	0.001
Vitamin D; n (%)	1 (1.67)	7 (35.00)	<0.001

BMI=body mass index; DM=diabetes mellitus; RA=rheumatoid arthritis; CKD=chronic kidney disease; SD=standard deviation

35.0% (p=0.001), and vitamin D intake was 1.67% and 35.0% (p<0.001) in the patients with and without distal radius fractures, respectively. Other risk factors did not show significant differences between the two groups. Demographic data and risk factors of distal radius fracture are shown in Table 1.

No risk factors were found to be associated with surgical treatment and malunion. Demographic data and risk factors of surgical treatment and malunion are shown in Table 2 and 3, respectively.

The present study found that being female was a risk factor for distal radius fractures in the elderly more than male (OR 4.71, 95% CI 1.25 to 17.72). Calcium intake and vitamin D intake were protective factors against distal radius fractures in the elderly (OR 0.06, 95% CI 0.01 to 0.34 and OR 0.03, 95% CI 0.00 to 0.28), respectively. To control for potential confounding factors, a multivariate logistic regression analysis was performed. After adjusting for gender, calcium and vitamin D intake remained significant protective factors, with adjusted OR 0.05 (95% CI 0.01 to 0.28) for calcium intake and 0.02 (95% CI 0.00 to 0.22) for vitamin D intake, as shown in Table 4.

This analysis confirmed that calcium and vitamin D intake independently reduced the risk of

Table 2. Demographic data and risk factors of patients compared between surgical treatment and conservative treatment group

Variable	Surgical treatment (n=11)	Conservative treatment (n=49)	p-value
Age (years); mean±SD	67.00±4.20	70.71±7.75	0.131
Gender; n (%)			1
Female	10 (90.91)	45 (91.84)	
Male	1 (9.09)	4 (8.16)	
BMI; mean±SD	24.03±3.88	24.02±4.02	0.995
DM; n (%)	5 (45.45)	9 (18.37)	0.107
RA; n (%)	0 (0.00)	1 (2.04)	1
CKD; n (%)	4 (36.36)	7 (14.29)	0.104
Electrolyte imbalance; n (%)	1 (9.09)	10 (20.41)	0.670
Smoking; n (%)	0 (0.00)	2 (4.08)	1
Alcohol drinking; n (%)	0 (0.00)	1 (2.04)	1
Season; n (%)			0.749
Winter	4 (36.36)	15 (30.61)	
Summer	1 (9.09)	11 (22.45)	
Rainy	6 (54.55)	23 (46.94)	
Time; n (%)			1
Day	9 (81.82)	37 (75.51)	
Night	2 (18.18)	12 (24.49)	
Calcium; n (%)	0 (0.00)	2 (4.08)	1
Vitamin D; n (%)	0 (0.00)	1 (2.04)	1

BMI=body mass index; DM=diabetes mellitus; RA=rheumatoid arthritis; CKD=chronic kidney disease; SD=standard deviation

Table 3. Demographic and risk factors of patients compared between malunion and no malunion group

Variable	Malunion (n=14)	No malunion (n=46)	p-value
Age (years); mean±SD	72.14±9.49	69.39±6.55	0.222
Gender; n (%)			0.078
Female	11 (78.57)	44 (95.65)	
Male	3 (21.43)	2 (4.35)	
BMI; mean±SD	23.75±3.91	24.10±4.01	0.771
DM; n (%)	3 (21.43)	11 (23.91)	1
RA; n (%)	1 (7.14)	0 (0.00)	0.233
CKD; n (%)	1 (7.14)	10 (21.74)	0.430
Electrolyte imbalance; n (%)	3 (21.43)	8 (17.39)	0.707
Smoking; n (%)	2 (14.29)	0 (0.00)	0.051
Alcohol drinking; n (%)	1 (7.14)	0 (0.00)	0.233
Season; n (%)			0.923
Winter	5 (35.71)	14 (30.43)	
Summer	3 (21.43)	9 (19.57)	
Rainy	6 (42.86)	23 (50)	
Time; n (%)			1
Day	11 (78.57)	35 (76.09)	
Night	3 (21.43)	11 (23.91)	
Calcium; n (%)	0 (0.00)	2 (4.35)	1
Vitamin D; n (%)	0 (0.00)	1 (2.17)	1

BMI=body mass index; DM=diabetes mellitus; RA=rheumatoid arthritis; CKD=chronic kidney disease; SD=standard deviation

Table 4. Univariate and multivariate logistic regression analysis of risk factors for elderly distal radius fracture patients

Variable	Univariable		Multivariable (adjusted for gender)	
	OR	95% CI	Adjusted OR	95% CI
Gender	4.71	(1.25 to 17.72)		
Calcium	0.06	(0.01 to 0.34)	0.05	(0.01 to 0.28)
Vitamin D	0.03	(0.00 to 0.28)	0.02	(0.00 to 0.22)

OR=odds ratio; CI=confidence interval

distal radius fractures in the elderly, emphasizing the importance of controlling for confounders to accurately identify protective factors. No other variables, including comorbidities, season, time of injury, smoking, and alcohol consumption, were significantly associated with the risk of distal radius fractures.

Discussion

The present study found that factors influencing distal radius fractures in the elderly included being female, calcium intake, and vitamin D intake. Being female was a risk factor. Calcium and vitamin D intake were protective factors. No factors were found associated with surgical treatment and malunion.

In the present study, being female was identified as a significant risk factor for distal radius fractures in the elderly. This finding is consistent with Brogren's study, which found that female gender increased the risk of distal radius fractures. A study in Sweden examining the relationship between distal radius fractures and gender found an overall incidence rate, across all age groups, of 3.3:1 for females to males, primarily due to rapid decline in bone mineral density (BMD) following menopause. The loss of estrogen in postmenopausal women accelerates bone resorption[9]. The result of the present study aligns with these findings, suggesting that hormonal changes in elderly females may significantly contribute to higher risk of distal radius fractures.

Ye et al. reported a cross-sectional study that identified frequent alcohol drinking (OR 1.96, 95% CI 1.36 to 2.81) and current smoker (OR 1.81, 95% CI 1.32 to 2.65) as independent risk factors for wrist fractures in multivariate analysis[10]. In contrast, a case-control study by Oyen et al. found no significant association between smoking and the risk of distal radius fractures, the odds ratios for smoking were 1.0 (95% CI 0.7 to 1.4) for females and 0.8 (95% CI 0.1 to 2.3) for males[8]. Similarly, the present study did not find a significant association between alcohol drinking or smoking and the risk of distal radius fractures. The absence of significant associations in the present study may be due to the small sample size, which could have limited the statistical power to detect associations between alcohol drinking or smoking, and the risk of distal radius fractures.

Seasonal and time-of-day factors were not found to significantly influence distal radius fractures in the elderly in the present study. This contrasts with the study by Flinkkilä et al. in Finland, which found that the incidence of distal radius fractures was 1.4 times higher (95% CI 1.1 to 1.9) during winter than in other seasons. Additionally, on slippery days during winter, the incidence was 2.5 times higher (95% CI 1.6 to 4.0)[11]. The absence of a similar pattern in the present study can be attributed to geographic and climatic differences between Thailand and the countries with cold climates. Thailand's tropical climate, characterized by relative stable temperatures and the absence of snow or ice, may minimize seasonal variations in fall risks. Although the rainy season could potentially increase the risk of slips and falls due to wet surfaces, the effect may not be as pronounced as the risks associated with snow and ice in colder regions.

Calcium and vitamin D intake were protective factors against distal radius fractures in the elderly in the present study. The finding is consistent with previous research. For instance, a study by Bischoff-Ferrari et al. found that calcium intake reduced the risk of fractures from low-energy trauma at various sites (HR 0, 95% CI 0 to 0.50)[12]. Additionally, a meta-analysis of randomized controlled trials found that vitamin D supplementation could prevent non-vertebral fractures, with a pooled relative risk of 0.86 (95% CI 0.77 to 0.96)[13]. However, the dose was unspecified. Similarly, Tang et al. found that the combined use of calcium and vitamin D supplementation was associated with a reduced risk of fractures in elderly populations (RR 0.88, 95% CI 0.83 to 0.95). These findings reinforce the importance of adequate calcium and vitamin D intake in preventing fractures among the elderly[14].

The outcomes of surgical treatment and malunion may depend more on factors such as the severity of trauma, fracture configuration and displacement, and patient compliance, rather than demographic data. This could explain why no significant associations were found between demographic variables and the outcomes of surgical treatment and malunion in the present study.

The present study has limitations. First, the retrospective design based on medical records

restricted the ability to collect certain important information, such as BMD and laboratory measurements of calcium and vitamin D levels, which could have provided a more comprehensive assessment of fracture risk factors. The reliance on existing medical records also introduces the possibility of information bias due to incomplete or inaccurate documentation. Second, the small sample size, may have limited the statistical power to detect significant associations between certain variables and outcomes like surgical treatment and malunion. A larger sample size could improve the reliability of the findings. Lastly, the present study population was limited to elderly residents of Bang Khae District, which may introduce selection bias and limit the generalizability of the results to other populations with different demographic or geographical characteristics. Despite these limitations, the present study provides valuable insights into the risk factors for distal radius fractures in the elderly and offers a novel investigation into the impact of time-of-day and seasonal factors on fracture risk, which has not been previously studied in Thailand. Future research with a larger and more diverse sample, as well as prospective study designs, would help validate these findings and address the identified limitations.

Conclusion

The present study found that elderly female patients have a higher risk of distal radius fractures compared to males, while calcium and vitamin D intake were identified as protective factors against such fractures. The protective effects observed in the present study emphasize the importance of ensuring adequate intake of these nutrients among elderly.

To enhance bone health and reduce fracture risk, it is important to implement nutrition education programs that promote the consumption of foods rich in calcium and vitamin D. Additionally, recommending calcium and vitamin D supplements may be particularly beneficial for individuals at high risk of deficiency, such as postmenopausal women and elderly individuals with limited sun exposure. Establishing routine screening for vitamin D deficiency and BMD assessments in elderly could help in preventing fractures.

Implementing these strategies could significantly reduce the risk of distal radius fractures in the elderly, and potentially lower healthcare costs associated with fracture management. Future studies with larger sample sizes and more diverse populations are recommended to validate these findings and to explore additional protective factors.

What is already known about this topic?

Female gender is a risk factor of distal radius fracture in elderly, while calcium and vitamin D intake are potential protective factors.

What does this study add?

The present study shows consistent results with other studies regarding the protective effect of calcium and vitamin D intake against distal radius fractures in elderly. Time-of-day and seasonal factors, which have not been previously studied in Thailand, are not associated with the risk of distal radius fracture in elderly.

Acknowledgement

The present study received funding support from the Medical Council of Thailand (Police General Dr. Jongjate Aojanepong Foundation).

Conflicts of interest

The authors declare no conflict of interest.

References

1. Hagino H, Fujiwara S, Nakashima E, Nanjo Y, Teshima R. Case-control study of risk factors for fractures of the distal radius and proximal humerus among the Japanese population. Osteoporos Int 2004;15:226-30.
2. Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. Lancet 2013;381:752-62.
3. MacIntyre NJ, Dewan N. Epidemiology of distal radius fractures and factors predicting risk and prognosis. J Hand Ther 2016;29:136-45.
4. Levin LS, Rozell JC, Pulos N. Distal radius fractures in the elderly. J Am Acad Orthop Surg 2017;25:179-87.
5. Mauck BM, Swigler CW. Evidence-based review of distal radius fractures. Orthop Clin North Am 2018;49:211-22.
6. Court-Brown CM, Caesar B. Epidemiology of adult fractures: A review. Injury 2006;37:691-7.
7. Nellans KW, Kowalski E, Chung KC. The epidemiology of distal radius fractures. Hand Clin 2012;28:113-25.
8. Oyen J, Brudvik C, Gjesdal CG, Tell GS, Lie SA, Hove LM. Osteoporosis as a risk factor for distal radial fractures: a case-control study. J Bone Joint Surg Am 2011;93:348-56.
9. Brogren E, Petranek M, Atroshi I. Incidence and characteristics of distal radius fractures in a southern Swedish region. BMC Musculoskelet Disord 2007;8:48. doi: 10.1186/1471-2474-8-48.
10. Ye J, Li Q, Nie J. Prevalence, characteristics, and

associated risk factors of wrist fractures in Americans above 50: The Cross-Sectional NHANES Study. Front Endocrinol (Lausanne) 2022;13:800129.
11. Flinkkilä T, Sirniö K, Hippi M, Hartonen S, Ruuhela R, Ohtonen P, et al. Epidemiology and seasonal variation of distal radius fractures in Oulu, Finland. Osteoporos Int 2011;22:2307-12.
12. Bischoff-Ferrari HA, Rees JR, Grau MV, Barry E, Gui J, Baron JA. Effect of calcium supplementation on fracture risk: a double-blind randomized controlled trial. Am J Clin Nutr 2008;87:1945-51.
13. Bischoff-Ferrari HA, Willett WC, Wong JB, Stuck AE, Staehelin HB, Orav EJ, et al. Prevention of nonvertebral fractures with oral vitamin D and dose dependency: a meta-analysis of randomized controlled trials. Arch Intern Med 2009;169:551-61.
14. Tang BM, Eslick GD, Nowson C, Smith C, Bensoussan A. Use of calcium or calcium in combination with vitamin D supplementation to prevent fractures and bone loss in people aged 50 years and older: a meta-analysis. Lancet 2007;370:657-66.