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Original article

Epidemiology and risk factors for contralateral proximal femur fracture: a single center retrospective cohort study on 1022 patients

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Summary. *Background and aim of the work:* Given the high impact of proximal femur fractures (PFFs) on elderly patients and healthcare systems, the burden of contralateral PFFs might be overlooked. Aim of the study is to analyze the epidemiology and risk factors of contralateral proximal femur fractures. Secondary aim is to detect mortality rate differences in first and contralateral PPF. *Methods:* A population of 1022 patients admitted for proximal femur fractures in a single center was studied. Prevalence at admission as well as incidence of contralateral PFF during a 18 to 36 months follow-up was recorded. Epidemiology of contralateral PFF was studied recording number of events, time to second fracture and fracture type. Mortality at 1-year was recorded for all patients and compared between first and second PFF patients. Comorbidities, pharmacotherapy, BMI, MNA and SPMSQ were studied as possible risk factors. *Results:* Prevalence and incidence of contralateral PFFs were 9.4% and 6.5% respectively. Median time to second fracture was 12 months. One-year mortality of contralateral PFFs was significantly lower (20.5% vs 25.1%, p 0.003) than first PFF. Contralateral fracture patients had a significantly lower BMI and a significantly lower proportion of malnourished patients. *Conclusions:* The incidence and prevalence of contralateral PFFs is relevant. Mortality of contralateral PFFs results to be lower than first PFF. Patients with higher BMI and malnourished patients have a lower risk of contralateral PFF. (www.actabiomedica.it)

Key words: proximal femur fracture, hip fracture, contralateral, bilateral, risk factors

Background and aim of the work

Proximal femoral fractures (PFFs) are a relevant problem in developed countries. The high impact of these fractures on patients' quality of life, social independence and mortality is well known, as well as the relevant social and economic burden. The incidence of PFFs increases every year due to overall aging of the population and prevalence of osteoporosis. In Italy, the incidence of hip fracture for patients > 65 years old was of 77.8 per 10.000 in 2009, showing an increase of 29.8% between 2000 and 2009 (1). These fractures are still the main indication for hospitalization and surgical treatment in the elderly (2-3).

The number of PFFs is rising despite the huge efforts of global and local healthcare systems to identify risk factors and to develop new prevention and treatment strategies. Besides high morbidity and mortality rates, patients who suffer from a PFF have an increased risk of undergoing a second fragility fracture, including a contralateral PFF (4). The incidence of contralateral PFF has been reported to be 2-5% within 12 months in some literature reports (4,5,6). Risk factors for contralateral PFF still have to be clearly determined, possibly including dementia, cardiac disease, institutionalization, vision impairment and respiratory disease (7, 8).

Aim of the study is to analyze the epidemiology and risk factors of contralateral proximal femur fractures

on a large cohort of PFF patients treated in a single center. Secondary aim of the study is to detect mortality rate differences in first PPF and contralateral PPF.

Patients and method

The study population counts 1022 patients admitted for PPF to the Orthopaedics and Traumatology Unit of Cattinara University Hospital in Trieste (Italy) between January 2016 and December 2017. Exclusion criteria were the following: patients aged < 65 years old, periprosthetic fractures, ipsilateral second fracture, pathologic fractures.

Patients data were retrospectively analyzed through institutional medical records and registry data between January and June 2019.

For all patients, demographic data (age, sex) were registered. Prevalence of previous contralateral fracture at admittance was recorded. The incidence of contralateral fractures occurring during a period of 18 to 36 months of follow-up in patients who sustained the first PFF within the January 2016-December 2017 interval was also registered, together with the time interval occurring from first and second fracture. Data regarding fracture type (medial or lateral PFF) were registered in all contralateral fracture patients to assess whether the second fracture was of the same type as the first fracture.

Patients admitted with a contralateral fracture (Group A) or who underwent a contralateral fracture during follow-up (Group B) were grouped and data compared with unilateral fracture patients (Group C) to evaluate differences in mortality rate between unilateral and contralateral fractures at one month and 1 year.

For Group B and C more data were registered and compared in order to detect possible risk factors for contralateral fracture. Comorbidities were registered grouped into the following categories: hypertension and cardiac diseases (cardiac insufficiency, myocardial infarction, angina pectoris, arrythmia), respiratory diseases (chronic obstructive pulmonary disease, chronic respiratory insufficiency), diabetes mellitus, renal and liver insufficiency, visual impairment, balance disorders, alcohol consumption, smoking. Regarding pharmacotherapy, previous long term or high dosage systemic corticosteroid therapy was recorded, as well as pharmacological therapies for osteoporosis (Vitamin D and/or antiresorptive drugs) in use at admission. Patients were also divided according to body mass index (BMI), into three groups: underweight (BMI < 18.5), normal weight (BMI 18.5-25) and overweight/obese patients (BMI > 25). Data regarding nutritional and mental status, respectively evaluated with the Mini Nutritional Assessment (MNA) and the Short Portable Mental Status Questionnaire (SPMSQ) at admittance, were recorded as well. According to MNA values patients were divided into three groups: malnourished (score < 17), at risk of malnutrition (score between 17 and 23.5) and well-nourished (score ≥ 23.5).

Statistical analysis

The statistical analysis was performed using the SPSS software. The dichotomous variables were compared using the Fischer's exact test. Categorical variables were compared using the chi-squared test. Quantitative variables were analyzed using the Mann-Whitney U test. *P* values of < 0.05 were considered statistically significant.

Results

The study population counted 1022 patients, 795 (77,8%) female and 227 (22,2%) male, median age 85 yrs (range 65-107 yrs) (Table 1).

The prevalence of contralateral fractures at admittance was 9.4% (96/1022 patients, Group A). The incidence of contralateral fractures occurring during follow-up was 6.5% (60/926 patients, Group B).

The 866 patients who neither presented a contralateral fracture at admittance nor developed a contralateral fracture at follow up constituted Group C.

The median (IQR) interval between the first and second fracture in Group B was 12 months. In detail, the second fracture occurred within 12 months in 28 patients (47%) and in 54 patients (85%) within 24 months.

Most contralateral PFFs were of the same type as the first fracture (73.1%, 114/156). In detail, 61 out of 79 (77.2%) were lateral fractures, while 53 out of 77 (68,8%) were medial fractures.

Table 1. Demographic data of 1022 patients (age > 65 years) admitted for proximal femur fracture in 2016-2017

	Whole population *(n = 1022)*	Group A *(n = 96)*	Group B *(n = 60)*	Group A + Group B *(n = 156)*	Group C *(n = 866)*
Age (mean)	85	85,8	84,5	85,6	83,8
Sex (M/F)	227/795	15/81	9/51	24/127	203/663

Table 2. Mortality rate among groups at 30-days and at 1 year after surgery

Mortality	Group A + B (n = 156)	Group C (866)	*P value*
At 30 days	5 (3.2%)	37 (4.2%)	*1.000*
At 1 year	32 (20.5%)	217 (25.1%)	***0.031***

Mortality of the whole study population was 4.1% (42 patients) at 30 days and 24.4% (249 patients) at 1 year. Comparing first and contralateral fractures (Table 2), mortality in Group C was 4.2% (37 out of 866) at 30 days and 25.1% (217 out of 866) at 1 year, while mortality in Group A + B was 3.2% (5 patients out of 156) at 30 days and 20.5% (32 of 156) at 1 year. Mortality rate at 1 year resulted to be significantly higher in Group C (p-value 0.03).

Data regarding comorbidities, pharmacotherapy, BMI, MNA and SPMSQ, and for group B and C are resumed in Table 3.

There was no significant difference between Group B vs C regarding age, gender, comorbidities, pharmacotherapy and SPMSQ. Conversely, significant differences were found for BMI and MNA.

In detail, BMI resulted to be significantly higher in Group C both considering quantitative (*p* value = 0.035) and categorical values (*p* value = 0.025) distribution (Table 3). According to MNA, the mean score of group B and C are similar, respectively 22.7 and 22.3, but categorizing the two population in the three groups (malnourished, at risk of malnutrition and well-nourished) in Group C there was a significantly higher proportion of malnourished patients (*p* value = 0.048) (Table 3). Mortality at 1 year in malnourished patients was 47%.

Table 3. Analysis of variables between groups

	Group B *(n = 60)*	Group C *(n = 866)*	P value
Cardiologic diseases	33	526	*0.581*
Respiratory diseases	9	103	*0.406*
Diabetus mellitus	8	154	*0.592*
Renal/liver insufficiency	10	138	*0.853*
Visual impairments	19	339	*0.404*
Balance disorders	18	314	*0.481*
Alcohol consumption	12	240	*0.288*
Smoking	6	97	*1.000*
Corticosteroid therapy	3	22	*0.203*
Osteoporosis Treatment:			
Vit D	8	67	*0.132*
Bisphosphonates	1	18	*1.000*
BMI (Body Mass Index):			
mean value	22,94 (16-33)	24,16 (12-39)	***0.035***
< 18.5	4	78	
18.5-25	47	528	***0.025***
> 25	9	260	
MNA (Mini Nutritional Assessment):			
mean score	22,7(13-29,5)	22,3(5,5-30)	*0.976*
< 17	3	127	
17-23.5	31	334	***0.048***
≥ 23.5	26	405	
SPMSQ (Short Portable Mental Status Questionnaire):			
mean score	4,3 (0-10)	3,7 (0-10)	*0.115*
0-2 errors	21	415	
3-4 errors	16	148	*0.183*
5-7 errors	9	126	
8-10 errors	14	177	

Discussion

There is a lack of evidence about epidemiology, risk factors and outcome of contralateral PFFs. In the present study, the cumulative incidence of contralateral PFF at final follow-up was 6.5%. However, the slightly higher prevalence registered in the present study

(9.4%) might suggest the incidence to raise with longer follow-up. Indeed, the incidence of contralateral PFF raised consistently during follow-up, from 3.2% at one year to 6.5% at final follow-up. In the meta-analysis performed by Zhu et al. in the 23 studies analyzed the overall incidence of contralateral PFF was found to be 8,5% in a period ranged from 9 months to 22 years (9). More recently, Muller et al. found an overall incidence of 10,4% in a cohort of 2296 patients at 10 years of follow up (10). However, there is no clear evidence on the ideal follow-up length required to detect a more reliable incidence value, which actually seems to vary between 5 and 11% (4, 11-21).

Nevertheless, a contralateral PFF was more likely to occur in the early period in many studies, reporting a higher incidence in the first 2 years (4,15,16). The present study data are in line with these findings, with more than 80% of cases occurred during the first 24 months.

In the present study most contralateral PFFs were of the same type as the first fracture, especially in lateral fracture pattern. These data are consistent with other literature reports (5,13,16,17,20, 22-29), suggesting that factors related to specific anatomic and gait aspects could more probably lead to a medial or a lateral fracture in different patients (25, 27, 29, 30).

Given the high impact of PFF on patients and healthcare systems, the burden of contralateral PFF might be overlooked. However, literature data about outcome seem not to differ significantly between first and second PFFs. Mortality is reported to be comparable after the first and second fracture in many studies, with some authors reporting lower mortality rates for contralateral fractures (21,22,31,32).The present study data are in line with this finding, with a significantly lower mortality rate in contralateral PFFs at 1 year (20.5% vs 25.1%, p-value 0.03). The reasons for this result might reside in the higher mortality rate after the first fracture in patients with severe comorbid conditions. Several studies have reported a high 1-year mortality rate in these patients (33,34). This might lead patients in better conditions who survive the first event to have higher chances to survive the second event as well. Nevertheless, the impact of each single comorbidity on mortality has not been evaluated in the present study. A better functional status in contralateral fracture patients compared with first fracture patients is similarly reported in literature (31,35-37).

Gender is debated to be a possible risk factor for contralateral PFF, based on the clearly demonstrated higher risk of PFF in elderly women (8,38). The results of the literature on this topic are conflicting. A metaanalysis performed by Liu et al. (7) seem to confirm this hypothesis. However, in the present study no difference in contralateral PFF incidence was found according to gender. This result is consistent with many other studies (39-42). These conflicting findings are also reported for age and comorbidities. In detail, comorbid conditions were not found to be related with contralateral PFF in the present and in other studies (18,41,42). However, Chang et al. (8) revealed a significant association for both dementia and respiratory diseases with contralateral PFF. Mitani et al. (40) identified postoperative delirium, visual impairment and respiratory diseases as risk factors. Concerning mental status, SPMSQ score has been previously used to value the influence of cognitive status on outcome and mortality rate after a hip fracture (43,44), but not as risk factor for secondary PFF. Nonetheless, it was not significantly associated to contralateral PFF in the present study.

The association between high doses of corticosteroids and PFF is well known, due to reduction of bone mineral density (45,46). Likely, Shan et al reported use of steroids as a significant predictor also for second hip fracture (47). Data retrieved in the present study could not confirm this statement, possibly due to the very low number of patients constituting the corticosteroid therapy group. Antiresorptive medications for osteoporosis treatment are an efficient preventative strategy for patients with high risk for controlateral fractures (47-49). In the present study, no significant differences in osteoporosis treatment was noted between single or bilateral fracture patients. However, only treatment in use at admission was registered. Nonetheless, in literature the effective role of bisphosphonates in tertiary prevention of osteoporosis remains unclear. In fact, some papers reported that bisphosphonates therapy may be protective against a secondary hip fracture (46,50), while others did not find any statistically significant correlation (28,51,52).

Conversely, a higher BMI appears to be protective for hip fractures in many studies (53-55). Many theories have been proposed to explain this protective role of higher BMI. More sedentary subjects could be less likely to fall and sustain a fracture (56). The fat tissue covering the hip could have a cushioning effect (57,58). The higher levels of calcitonin and the greater production of estrogens by the adipocytes (59) may also play a role. Interestingly, higher BMI has been also recognized to be associated to a lower incidence of contralateral PFF by Berry et al. (35), probably for the same reasons. The results of the present study seem to confirm this finding, with contralateral fracture patients having significantly lower BMI values. Similarly, contralateral PFF risk might be related to malnutrition. At our knowledge, MNA was not previously analyzed as possible risk factor for contralateral PFF. In the present study, MNA values demonstrated a significantly higher proportion of malnourished patients in Group C. Beside the considerations already discussed for BMI that might probably apply to nutritional status, mortality rate should also be taken into account. In the present study, mortality rate at one year in malnourished patients was 47%. This is consistent with data found by Bell et al. and Zanetti et al. who found a poor nutritional status to be an independent predictor of mortality at 1 year after PFF (33,59). The high mortality rate of malnourished patients could have effectively affected the proportion of patients in which contralateral PFF could occur.

Conclusions

Independent risk factors for contralateral PFF still have to be clearly determined. A higher BMI seems to be protective for contralateral PFF while malnutrition is negatively associated to contralateral PFF, probably due to high mortality rates after first fracture. Mortality in contralateral PFF results to be significantly lower with respect to first PFF at 1 year.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

References

1. Piscitelli P, Feola M, Rao C, et al.Ten years of hip fractures in Italy: For the first time a decreasing trend in elderly women. World J Orthop 2014; 5(3):386–391
2. Ratti C, Vulcano E, La Barbera G, Canton G, Murena L, Cherubino P. The incidence of fragility fractures in Italy. Aging Clin. Exp Res 2013; 25(Suppl 1):S13–S14
3. Zurlo A, Bellelli G. Orthogeriatrics in Italy: the Gruppo Italiano di Ortogeriatria (GIOG) audit on hip fractures in the elderly. Geriatric Care 2018;4(2):33–35
4. Vochteloo AJH, Van Der Burg BLSB, Röling MA, et al. Contralateral hip fractures and other osteoporosis-related fractures in hip fracture patients: Incidence and risk factors. An observational cohort study of 1,229 patients. Arch Orthop Trauma Surg 2012;132(8):1191–1197
5. Boston DA. Bilateral fractures of the femoral neck. Injury 1982;14:207–210
6. Dretakis E, Kritsikis N, Economou K, Christodoulou N. Bilateral non-contemporary fractures of the proximal femur. Acta Orthop 1981; 52:227–229
7. Liu, S., Zhu, Y., Chen, W. et al. Risk factors for the second contralateral hip fracture in elderly patients: A systematic review and meta-analysis**.** Clin Rehabil 2015; 29: 285–294
8. Chang Jh, Yoo JH, Reddy P, Lee SS, Hwang JH, Kim TY. Risk factors for contra-lateral hip fracture in elderly patients with previous hip fracture. Injury 2013;44(12):1930–1933
9. Zhu Y, Chen W, Sun T, Zhang Q, Liu S, Zhang Y. Epidemiological characteristics and outcome in elderly patients sustaining non-simultaneous bilateral hip fracture: a systematic review and meta-analysis. Geriatr Gerontol Int 2015;15(1):11–18.
10. Müller F, Galler M, Zellner M, Bäuml C, Roll C, Füchtmeier B. Comparative analysis of non-simultaneous bilateral fractures of the proximal femur. Eur J Trauma Emerg Surg 2019;45(6):1053–1057
11. Finsen V, Benum P (1986) The second hip fracture an epidemiologic study. An epidemiologic study. Acta Orthop Scand 1986;57(5)431–433
12. Van Der Steenhoven TJ, Staffhorst B, Van De Velde SK, Nelissen RGHH, Verhofstad MHJ. Complications and institutionalization are almost doubled after second hip fracture surgery in the elderly patient. J Orthop Trauma 2015;29(3):e103-e108
13. Aurégan JC, Frison A, Bégué T, et al. Contra-lateral hip fracture in the elderly: are decreased body mass index and skin thickness predictive factors? Int Orthop 2017;41(2) 247–252
14. Shabat S, Gepstein R, Mann G, Kish B, Fredman B, Nyska M. The second hip fracture - An analysis of 84 elderly patients. J Orthop Trauma 2003;17(9):613–617
15. Pearse EO, Redfern DJ, Sinha M, Edge AJ. Outcome following a second hip fracture. Injury 2003;34(7):518–521
16. Fukushima T, Sudo A, Uchida A. Bilateral hip fractures. J Orthop Sci. 2006;11(5)435–438
17. Lönnroos E, Kautiainen H, Karppi P, Hartikainen S,

Kiviranta I, Sulkava R. Incidence of second hip fractures. A population-based study. Osteoporos Int 2007;18(9):1279–1285
18. Gaumetou E, Zilber S, Hernigou P. Non-simultaneous bilateral hip fracture: Epidemiologic study of 241 hip fractures. Orthop Traumatol Surg Res 2011;97(1):22–27
19. Kaukonen JP, Lüthje P, Nurmi-Lüthje I, Kataja M, Naboulsi H. Second hip fracture and patients' medication after the first hip fracture: A follow-up of 221 hip fracture patients in Finland. Arch Gerontol Geriatr 2011;52(2)185–189
20. Khan SK, Rushton SP, Dosani A, Gray AC, Deehan DJ. Factors influencing length of stay and mortality after first and second hip fractures: an event modeling analysis. J Orthop Trauma. 2013;27(2):82–86.
21. Harvey L, Toson B, Mitchell R, Brodaty H, Draper B, Close J. Incidence, timing and impact of comorbidity on second hip fracture: a population-based study. ANZ J Surg. 2018;88(6):577–581.
23 Yamanashi A, Yamazaki K, Kanamori M, et al. Assessment of risk factors for second hip fractures in Japanese elderly. Osteoporos Int. 2005;16(10):1239–1246.
24. Saxena P, Shankar J. Contralateral hip fractures - can predisposing factors be determined?. Injury. 2000;31(6): 421–424
25. Kok LM, van der Steenhoven TJ, Nelissen RG. A retrospective analysis of bilateral fractures over sixteen years: localisation and variation in treatment of second hip fractures. Int Orthop. 2011;35(10):1545–1551.
26. Lawrence TM, Wenn R, Boulton CT, Moran CG. Age-specific incidence of first and second fractures of the hip. J Bone Joint Surg Br. 2010;92(2):258–261
27. Sawalha S, Parker MJ. Characteristics and outcome in patients sustaining a second contralateral fracture of the hip. J Bone Joint Surg Br. 2012;94(1):102–106.
28. Hagino H, Sawaguchi T, Endo N, Ito Y, Nakano T, Watanabe Y. The risk of a second hip fracture in patients after their first hip fracture. Calcif Tissue Int. 2012;90(1):14–21.
29. Chapurlat RD, Bauer DC, Nevitt M, Stone K, Cummings SR. Incidence and risk factors for a second hip fracture in elderly women. The Study of Osteoporotic Fractures. Osteoporos Int. 2003;14(2):130–136
30. Pellegrini A, Tacci F, Leigheb M, Costantino C, Pedrazzini A, Pedrazzi G, Vaienti E, Ceccarelli F, Pogliacomi F. Injuries of the trochanteric region: can analysis of radiographic indices help in prediction of recurrent osteoporotic hip fractures? Acta Biomed. 2017 Oct 18;88(4 -S):43–9.
31. Ryg J, Rejnmark L, Overgaard S, Brixen K, Vestergaard P. Hip fracture patients at risk of second hip fracture: a nationwide population-based cohort study of 169,145 cases during 1977–2001. J Bone Miner Res. 2009;24(7):1299–1307
32. Skála-Rosenbaum J, Džupa V, Bartoška R, Říha D, Waldauf P, Báča V. Subsequent contralateral hip fractures: can at-risk patients be identified? An observational study of 5,102 patients. Int Orthop. 2015;39(4):755–760.
33. Bell JJ, Pulle RC, Crouch AM, Kuys SS, Ferrier RL, Whitehouse SL. Impact of malnutrition on 12-month mortality following acute hip fracture. ANZ J Surg. 2016;86(3):157–161.
34. Hindmarsh D, Loh M, Finch CF, Hayen A, Close JC. Effect of comorbidity on relative survival following hospitalisation for fall-related hip fracture in older people. Australas J Ageing. 2014;33(3):E1–E7.
35. Berry SD, Samelson EJ, Hannan MT, et al. Second hip fracture in older men and women: the Framingham Study. Arch Intern Med. 2007;167(18):1971–1976
36. Kim SM, Moon YW, Lim SJ, et al. Prediction of survival, second fracture, and functional recovery following the first hip fracture surgery in elderly patients. Bone. 2012;50(6):1343–1350
37. Holt G, Smith R, Duncan K, Hutchison JD, Gregori A, Reid D. Outcome after sequential hip fracture in the elderly. J Bone Joint Surg Am. 2012;94(19):1801–1808
38. Johnell O, Gullberg B, Allander E, Kanis JA; MEDOS Study Group. The apparent incidence of hip fracture in Europe: a study of national register sources. Osteoporos Int. 1992;2(6):298–302
39. Melton LJ 3rd, Kearns AE, Atkinson EJ, et al. Secular trends in hip fracture incidence and recurrence. Osteoporos Int. 2009;20(5):687–694.
40. Mitani S, Shimizu M, Abo M, Hagino H, Kurozawa Y. Risk factors for second hip fractures among elderly patients. J Orthop Sci. 2010;15(2):192–197
41. Batin S, Ozan F, Gurbuz K, Koyuncu S, Vatansever F, Uzun E. Evaluation of Risk Factors for Second Hip Fractures in Elderly Patients. J Clin Med Res. 2018;10(3):217–220
42. Pogliacomi F, Pellegrini A, Tacci F, Pedrini MF, Costantino C, Pedrazzini A, Pedrazzi G, Lauretani F, Vaienti E, Ceccarelli F. Risks of subsequent contralateral fractures of the trochanteric region in elderly. Acta Biomed. 2016; 87(3): 275–81.
43. Sheikh HQ, Hossain FS, Khan S, Usman M, Kapoor H, Aqil A. Short-term risk factors for a second hip fracture in a UK population. Eur J Orthop Surg Traumatol. 2019;29(5):1055–1060.
44. Mukka S, Knutsson B, Krupic F, Sayed-Noor AS. The influence of cognitive status on outcome and walking ability after hemiarthroplasty for femoral neck fracture: a prospective cohort study. Eur J Orthop Surg Traumatol. 2017; 27(5):653–658.
45. Söderqvist A, Ekström W, Ponzer S, et al. Prediction of mortality in elderly patients with hip fractures: a two-year prospective study of 1,944 patients. Gerontology. 2009;55(5):496–504.
46. van Staa TP, Leufkens HG, Abenhaim L, Zhang B, Cooper C. Oral corticosteroids and fracture risk: relationship to daily and cumulative doses. Rheumatology (Oxford). 2000; 39(12):1383–1389.
47. Shen SH, Huang KC, Tsai YH, et al. Risk analysis for second hip fracture in patients after hip fracture surgery: a nationwide population-based study. J Am Med Dir Assoc. 2014;15(10):725–731.

48. Morin S, Rahme E, Behlouli H, Tenenhouse A, Goltzman D, Pilote L. Effectiveness of antiresorptive agents in the prevention of recurrent hip fractures. Osteoporos Int. 2007;18(12):1625–1632.
49. Lyles KW, Colón-Emeric CS, Magaziner JS, et al. Zoledronic acid and clinical fractures and mortality after hip fracture. N Engl J Med. 2007;357(18):1799–1809.
50. Osaki M, Tatsuki K, Hashikawa T, et al. Beneficial effect of risedronate for preventing recurrent hip fracture in the elderly Japanese women. Osteoporos Int. 2012;23(2): 695–703
51. Lee YK, Ha YC, Yoon BH, Koo KH. Incidence of second hip fracture and compliant use of bisphosphonate (published correction appears in Osteoporos Int. 2014 Sep;25(9):2327). Osteoporos Int. 2013;24(7):2099–2104.
52. Besalduch M, Carrera I, Gómez-Masdeu M, De Caso J. Antiresorptive treatment, when initiated after a first hip fracture, may not protect of a second contralateral episode in elderly population: A study with 685 patients. Injury. 2016;47(4):877–880.
53. Suzuki N, Arai K, Kon S, et al. Challenges to prevent secondary fractures in patients with hip fractures in Joetsu Myoko, Japan through the increased use of osteoporosis treatment and collaboration with family doctors. J Bone Miner Metab. 2017;35(3):315–323
54. Young Y, Myers AH, Provenzano G. Factors associated with time to first hip fracture. J Aging Health. 2001;13(4): 511–526
55. De Laet C, Kanis JA, Odén A, et al. Body mass index as a predictor of fracture risk: a meta-analysis. Osteoporos Int. 2005;16(11):1330–1338.
56. Court-Brown CM, Duckworth AD, Ralston S, McQueen MM. The relationship between obesity and fractures. Injury. 2019;50(8):1423–1428.
57. Kiel DP, Felson DT, Anderson JJ, Wilson PW, Moskowitz MA. Hip fracture and the use of estrogens in postmenopausal women. The Framingham Study. N Engl J Med. 1987;317(19):1169–1174.
58. Cummings SR, Nevitt MC. A hypothesis: the causes of hip fractures. J Gerontol. 1989;44(4):M107–M111
59. Perez Cano R, Galan Galan F, Dilsen G. Risk factors for hip fracture in Spanish and Turkish women. Bone. 1993; 14 Suppl 1: S69–S72.
60. Zanetti M, Gortan Cappellari G, Ratti C, et al. Poor nutritional status but not cognitive or functional impairment per se independently predict 1-year mortality in elderly patients with hip-fracture. Clin Nutr. 2019;38(4):1607–1612

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