Characterization of Preceding Fragility Fractures in Patients With Hip Fractures: A Retrospective Analysis of 200 Cases

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ABSTRACT

Introduction: Osteoporosis is a disease characterized by decreased bone density that increases the risk of fractures, particularly in older adults. The objectives of this study were to document the frequency of fragility fractures preceding a hip fracture, the prevalence of each type of fracture, and the percentage of patients diagnosed and treated for osteoporosis prior to sustaining a hip fracture. **Materials and Methods:** A retrospective study was conducted in patients aged >65 years who underwent surgery for hip fracture between 2022 and 2023 at a single site, with a minimum follow-up of 12 months. Variables analyzed included age, sex, fracture type and treatment, prior diagnosis of osteoporosis, and the anatomical sites of preceding fragility fractures. **Results:** Two hundred patients were included (159 women and 41 men; mean age 83.04 years). Sixty patients (30%) had sustained a fragility fracture before the hip fracture. The most common locations were the contralateral hip (9%), spine (8%), and distal radius (6.5%). Of these patients, 48.33% had a prior diagnosis of osteoporosis. **Conclusions:** Thirty percent of patients experienced fragility fractures (also referred to as sentinel fractures) prior to a hip fracture. Implementing preventive strategies for diagnosis and treatment in this population is crucial to reduce the risk of subsequent fractures and improve quality of life.

Keywords: Osteoporosis; fragility fractures; hip fracture.

Level of Evidence: IV

Caracterización de las fracturas por fragilidad previas a una fractura de cadera. Estudio retrospectivo de 200 casos

RESUMEN

Introducción: La osteoporosis es una enfermedad caracterizada por la pérdida de densidad ósea que aumenta el riesgo de fracturas, especialmente en adultos mayores. Este estudio tiene como objetivos documentar la frecuencia de las fracturas por fragilidad previas a una fractura de cadera, la prevalencia de cada tipo de fractura y el porcentaje de pacientes con osteoporosis diagnosticada y tratada antes de la fractura de cadera. **Materiales y Métodos:** Se realizó un estudio retrospectivo en pacientes >65 años, operados por fractura de cadera entre 2022 y 2023, en un único Centro y que cumplieron un seguimiento mínimo de 12 meses. Se analizaron variables, como edad, sexo, tipo de fractura y tratamiento, diagnóstico previo de osteoporosis, antecedentes de localización de fracturas por fragilidad. **Resultados:** Se incluyó a 200 pacientes (159 mujeres y 41 hombres, edad promedio 83.04 años), 60 (30%) tenían fracturas por fragilidad previas a la fractura de cadera. Las localizaciones más comunes eran: cadera contralateral (9%), columna vertebral (8%) y radio distal (6,5%). El 48,33% de estos pacientes tenía diagnóstico de osteoporosis. **Conclusiones:** El 30% sufrió fracturas por fragilidad, también llamadas fracturas centinela, antes de una fractura de cadera. La implementación de estrategias de diagnóstico y tratamiento preventivos en estos pacientes es crucial para reducir el riesgo de nuevas fracturas y mejorar la calidad de vida.

Palabras clave: Osteoporosis; fracturas por fragilidad; fractura de cadera.

Nivel de Evidencia: IV

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INTRODUCTION

Due to increased life expectancy and the resulting aging population, osteoporosis has become a global epidemic.[1,2] Despite pharmacological advances in the prevention and management of this disease over recent decades, the incidence of fragility fractures in older adults continues to rise.[1,3] It is estimated that osteoporosis causes approximately 9 million fractures per year worldwide, a figure that has a substantial impact on healthcare systems.[4]

Fragility fractures are characterized by their occurrence spontaneously or following low-energy trauma in patients with osteoporosis. They most frequently involve the spine, hip, wrist, proximal humerus, and pelvis.[3] Numerous studies have attempted to identify predisposing factors for these injuries. Some of the most common include age, female sex, postmenopausal status, body mass index, use of estrogen and vitamin D supplements, and a prior history of fracture.[3] Regarding the latter, Haentjens et al. reported that, in postmenopausal women, a distal radius or vertebral fracture doubles the risk of sustaining a hip fracture. In another similar report, approximately half of the patients who sustained a hip fracture were found to have a history of a fragility fracture.[3,5] Consequently, a fragility fracture, also referred to as a sentinel fracture, has long been considered a warning sign. Early diagnosis and treatment of osteoporosis therefore become essential to prevent subsequent fractures.[3,4,6]

In developing countries such as ours, preventive treatments are either infrequently administered or entirely absent, and osteoporosis consequently remains underdiagnosed and undertreated.[7]

Based on this background, we hypothesized that a considerable number of fragility fractures occur prior to hip fractures in our setting. Therefore, the objectives of this retrospective study were: 1) to determine the frequency of fragility fractures preceding hip fractures treated at a single center; 2) to identify the anatomical distribution of these fractures; and 3) to determine the percentage of patients who had a prior diagnosis or treatment of osteoporosis before sustaining a hip fracture.

MATERIALS AND METHODS

A retrospective, descriptive, observational study was conducted to evaluate all patients consecutively operated on for hip fractures and recorded in our department's database between 2022 and 2023.

Inclusion criteria were: age >65 years; diagnosis of medial or lateral hip fracture; surgical treatment; and a minimum clinical follow-up of 12 months. Exclusion criteria were: fractures caused by high-energy mechanisms (e.g., traffic accidents, falls from height); fractures associated with underlying diseases affecting bone quality, such as rheumatoid arthritis or cancer; chronic corticosteroid therapy; and failure to complete the minimum follow-up period for reasons other than death.

Fragility fractures were defined according to the World Health Organization as fractures occurring from trauma insufficient to fracture a normal bone, resulting from compressive or torsional forces.[5]

Variables Analyzed

The following variables were analyzed: sex, age at the time of the hip fracture, type of hip fracture (medial or lateral), and type of treatment (osteosynthesis or arthroplasty). In addition, it was recorded whether the patient had a prior diagnosis of osteoporosis (based on bone mineral densitometry), whether they were receiving treatment, and the specific medication prescribed. A history of previous fractures and their anatomical location was also documented based on the medical record review, radiological archive, and targeted patient questioning.

Statistical Analysis

The collected data were entered into an Excel spreadsheet. Continuous variables are expressed as median and range, and categorical variables as frequency and percentage.

RESULTS

Fifteen of the 215 patients identified in the initial search were excluded (7 due to high-energy trauma, 5 for failing to meet the minimum follow-up requirement, and 3 for fractures related to cancer or rheumatoid arthritis).

The study population consisted of 200 patients (159 women and 41 men) with 200 hip fractures. The median age at the time of the hip fracture was 83.04 years (range 65–99). Eighty-five patients were treated with arthroplasty and 115 with osteosynthesis (Table 1).

Table 1. Patient data from the series

Age	83.04 years (range 55-99)
Gender	Male 41 (20.5%)
	Female 159 (79.5%)
Type of fracture	Medial 111 (55.5%)
	Lateral 89 (45.5%)
Treatment	Osteosynthesis 115 (57.5%)
	Arthroplasty 85 (42.5%)
Osteoporosis	68 (34%)
Treatment	84 (42%)

Sixty-eight patients had osteoporosis confirmed by densitometry, and 84 were receiving pharmacological treatment, which consisted, ordered by frequency, of: calcium plus vitamin D (25 cases), calcium alone (16 cases), vitamin D alone (14 cases), vitamin D plus bisphosphonates (10 cases), zoledronate (6 cases), bisphosphonates alone (5 cases), calcium plus zoledronate (5 cases), and calcium plus bisphosphonates (3 cases).

Previous Fragility Fractures

Thirty percent of the 200 patients had sustained at least one prior fragility fracture; 12 patients (6%) had sustained two fractures, and 3 patients (1.5%) had sustained three previous fragility fractures. The most frequent locations were the contralateral hip (9%, 18 cases), spine (8%, 16 cases), wrist (6.5%, 13 cases), and proximal humerus (4%, 8 cases) (Table 2).

Table 2. Description of the fractures in the series.

Preceding fracture	Number of patients
Contralateral hip	18 (9%)
Distal radius	13 (6.5%)
Spine	16 (8%)
Proximal humerus	8 (4%)
Pelvis	6 (3%)
Elbow	3 (1.5%)
Patella	3 (1.5%)
Ankle	3 (1.5%)
Femur (supracondylar)	1 (1.4%)

The median interval between the previous fragility fracture and the hip fracture was 24 months (range 1–384). Twenty-four patients (39.3%) sustained their hip fracture within the first year; 9 (14.7%) in the second year; 3 (4.9%) in the third year; 9 (14.7%) in the fourth year; and the remaining patients beyond this timeframe. Thus, 73.6% suffered a hip fracture within 4 years of their fragility fracture.

Regarding osteoporosis diagnosis and treatment, 29 (48.33%) of the 60 patients with prior fragility fractures had a diagnosis confirmed by densitometry, and only one patient (3.44%) was not receiving pharmacological treatment.

DISCUSSION

The main finding of our study was that 30% of patients with hip fractures had experienced a previous fragility fracture. Vertebral compression fractures and distal radius fractures were the most frequent. In our view, this highlights the importance of recognizing that encountering one of these fragility fractures, most of which are common even for general orthopedic surgeons, may represent a *sentinel fracture* for future injuries.

The identification of hip, vertebral, and wrist fractures as common fragility fractures is consistent with the findings of Lauritzen et al., and partially with those of Dang et al., who reported vertebral compression fractures and proximal humerus fractures as the most frequent.[7,8] In our series, proximal humerus fractures ranked fourth in frequency, with an incidence of 4%.

As noted, in our cohort, 30% of patients with hip fractures had a history of a fragility fracture, a figure lower than the 39.8% reported in an Irish population study.

The association between a fragility fracture and, specifically, a subsequent hip fracture has been widely documented. In 2019, Dang et al. evaluated more than one million patients and reported that 5.8%, 8.8%, and 11.3% of those with a prior fragility fracture sustained a new fracture within 12, 24, and 36 months, respectively.[8] Clinton et al. and Lauritzen et al. estimated that the risk of hip fracture is highest during the first year after a distal radius fracture (relative risk 1.9) or proximal humerus fracture (relative risk 2.7) in women aged 60–79 years.[7,9] Haentjens et al. also noted that Colles fractures significantly increase the risk of subsequent hip fractures in postmenopausal women. In our analysis, 10% of patients had a previous wrist or humerus fracture.[10]

In our series, more than 80% of patients with prior fractures were women—a percentage considerably higher than the 42.6% reported by McCarthy et al. and the 45% reported by Port et al.[11] This marked difference may be influenced by the fact that, in our country, according to the Morbidity and Mortality Committee of the Argentine Association of Orthopedics and Traumatology, approximately 75% of patients with hip fractures are women.

From another perspective, in a population composed mainly of elderly women (>80 years), approximately 73% of those with a fragility fracture sustained a hip fracture within the following four years.

This underscores the importance of multidisciplinary care, together with internal medicine physicians and endocrinologists, to promote actions aimed at reducing the incidence of subsequent fractures.

Finally, only 34% of the total sample had a diagnosis of osteoporosis, and 42% were receiving preventive pharmacological treatment. Among the 60 patients with a history of fragility fractures, only 48% had been formally diagnosed. This highlights the need to intensify not only diagnosis but also preventive treatment in high-risk groups.

The limitations of this study are inherent to its retrospective design and relatively small sample size, which make the analysis susceptible to confounding factors. Additional limitations include the high proportion of women in the cohort, which restricts generalizability to male patients, and the fact that the study was conducted at a single healthcare center in a specific geographic region, limiting extrapolation to the general population.

To our knowledge, this is the first study in Argentina to examine various types of fragility fractures and their association with subsequent hip fractures. The clinical implications of these findings reinforce the importance of proactive evaluation and management of osteoporosis in patients with fragility fractures, particularly in women over 65 years of age. Studies with larger populations are needed to determine the predictive value of these sentinel fractures in the broader national population.

CONCLUSIONS

Thirty percent of women over 65 who sustain a fragility fracture may suffer a hip fracture within the following four years. It is essential to implement appropriate preventive and therapeutic strategies to mitigate this risk, thereby optimizing patients' quality of life and reducing the associated economic burden.

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REFERENCES

1. Giannoudis PV, Schneider E. Principles of fixation of osteoporotic fractures. *J Bone Joint Surg Br* 2006;88(10):1272-8. https://doi.org/10.1302/0301-620X.88B10.17683
2. Long G, Liu C, Liang T, Zhang Z, Qin Z, Zhan X. Predictors of osteoporotic fracture in postmenopausal women: a meta-analysis. *J Orthop Surg Res* 2023;18(1):574. https://doi.org/10.1186/s13018-023-04051-6
3. McCarthy CJ, Kelly MA, Kenny PJ. Assessment of previous fracture and anti-osteoporotic medication prescription in hip fracture patients. *Irish J Med Sci* 2022;191(1):247-52. https://doi.org/10.1007/s11845-021-02571
4. Ward CM, Gullborg EJ, Simcock XC. The orthopedic upper extremity surgeon's role in the diagnosis and treatment of osteoporosis: Making use of opportunistic imaging. *J Clin Med* 2024;13(17):5095. https://doi.org/10.3390/jcm13175095
5. Cianferotti L, Porcu G, Ronco R, Adami G, Alvaro R, Bogini R, et al. The integrated structure of care: evidence for the efficacy of models of clinical governance in the prevention of fragility fractures after recent sentinel fracture after the age of 50 years. *Arch Osteoporos* 2023;18(1):109. https://doi.org/10.1007/s11657-023-01316-9
6. Valentin G, Ravn MB, Jensen EK, Friis K, Bhimjiyani A, Ben-Shlomo Y, et al. Socio-economic inequalities in fragility fracture incidence: a systematic review and meta-analysis of 61 observational studies. *Osteoporos Int* 2021;32(12):2433-48. https://doi.org/10.1007/s00198-021-06038-7
7. Lauritzen JB, Schwarz P, McNair P, Lund B, Transbøl I. Radial and humeral fractures as predictors of subsequent hip, radial or humeral fractures in women, and their seasonal variation. *Osteoporos Int* 1993;3(3):133-7. https://doi.org/10.1007/BF01623274
8. Dang DY, Zetumer S, Zhang AL. Recurrent fragility fractures: A cross-sectional analysis. *J Am Acad Orthop Surg* 2019;27(2):e85-e91. https://doi.org/10.5435/JAAOS-D-17-00103
9. Clinton J, Franta A, Polissar NL, Neradilek B, Mounce D, Fink HA, et al. Proximal humeral fracture as a risk factor for subsequent hip fractures. *J Bone Joint Surg Am* 2009;91(3):503-11. https://doi.org/10.2106/JBJS.G.01529
10. Haentjens P, Autier P, Collins J, Velkeniers B, Vanderschueren D, Boonen S. Colles fracture, spine fracture, and subsequent risk of hip fracture in men and women. A meta-analysis. *J Bone Joint Surg Am* 2003;85(10):1936-43. https://doi.org/10.2106/00004623-200310000-0001
11. Port L, Center J, Briffa NK, Nguyen T, Cumming R, Eisman J. Osteoporotic fracture: missed opportunity for intervention. *Osteoporos Int* 2003;14(9):780-4. https://doi.org/10.1007/s0019 8-003-1452-x