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ORIGINAL

Sociodemographic and clinical factors associated with fractures in older adults treated in a public hospital in Paraguay in 2024

Factores sociodemográficos y clínicos asociados a fracturas en adultos mayores atendidos en un hospital público de Paraguay en 2024

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ABSTRACT

Introduction: fractures in the elderly constitute a significant public health problem due to their high incidence and impact on morbidity and mortality. Globally, an estimated 178 million fractures occurred in 2019, a number that is increasing due to the aging population. Older adults, especially women, are most susceptible, and most of their fractures are caused by low-energy trauma (falls from standing height).
Objective: to identify the factors associated with fractures in older adults treated at a public hospital in Paraguay in 2024.
Method: a descriptive, cross-sectional observational study. One hundred patients aged ≥60 years with a history of bone fracture, treated at the Trauma Service of a surgical specialty hospital between January and July 2024, were included. Sociodemographic data, comorbidities (hypertension, diabetes), and fracture characteristics (anatomical location, mechanism, type, and treatment) were collected from medical records.
Results: the mean age was 76,3±7,9 years (median 77); 78 % were female. The average body mass index was ~25 kg/m². Sixty-nine percent had hypertension and 34 % had diabetes mellitus. The predominant mechanism was a fall from standing height (84 %). The most frequently affected bone was the proximal femur (61 %), followed by the distal radius (17 %) and the proximal humerus (10 %). Ninety-eight percent of the fractures were closed (non-compound), and all received surgical treatment.
Discussion: fragility fractures primarily affected older women with common comorbidities, typically occurring due to low-energy falls and affecting osteoporotic bones (hip, wrist, humerus). These findings are consistent with international literature and highlight the need to prevent falls and implement proactive management of bone health (e.g., treatment of osteoporosis) to reduce the incidence of fractures and their consequences in the elderly population.

Keywords: Bone Fracture; Elderly; Osteoporosis; Risk Factors; Frailty; Fall.

RESUMEN

Introducción: las fracturas en el adulto mayor constituyen un importante problema de salud pública por su alta frecuencia e impacto en la morbimortalidad. A nivel mundial se estimaron unos 178 millones de fracturas en 2019, cifra en aumento por el envejecimiento poblacional. Las personas mayores, especialmente las mujeres, son las más propensas, y la mayoría de sus fracturas se debe a traumatismos de baja energía (caídas desde su altura).
Objetivo: identificar los factores asociados a fracturas en adultos mayores atendidos en un hospital público de Paraguay en 2024.

Método: estudio observacional descriptivo, corte transversal. Se incluyeron 100 pacientes de ≥60 años con antecedente de fractura ósea, atendidos en el Servicio de Traumatología de un hospital de especialidades quirúrgicas entre enero y julio de 2024. Se recolectaron datos sociodemográficos, comorbilidades (hipertensión, diabetes) y características de las fracturas (sitio anatómico, mecanismo, tipo y tratamiento) a partir de las historias clínicas.

Resultados: la edad media fue 76,3±7,9 años (mediana 77); 78 % mujeres. El índice de masa corporal promedio fue ~25 kg/m². Un 69 % padecía hipertensión arterial y 34 % diabetes mellitus. El mecanismo etiológico predominante fue la caída casual de la propia altura (84 %). El hueso más afectado fue el fémur proximal (61 %), seguido por el radio distal (17 %) y el húmero proximal (10 %). El 98 % de las fracturas fueron cerradas (no expuestas) y todas recibieron tratamiento quirúrgico.

Discusión: las fracturas por fragilidad afectaron principalmente a mujeres de edad avanzada con comorbilidades frecuentes, ocurriendo típicamente por caídas de baja energía y comprometiendo huesos osteoporóticos (cadera, muñeca, húmero). Estos hallazgos concuerdan con la literatura internacional y resaltan la necesidad de prevenir las caídas e implementar un manejo proactivo de la salud ósea (p. ej., tratamiento de la osteoporosis) para reducir la incidencia de fracturas y sus consecuencias en la población geriátrica.

Palabras clave: Fractura Ósea; Adulto Mayor; Osteoporosis; Factores de Riesgo; Fragilidad; Caída.

INTRODUCTION

Osteoporotic fractures in older adults represent a growing global public health problem due to increased life expectancy and the consequent aging of the population. In 2019, there were approximately 178 million fractures worldwide, representing a 33 % increase compared to 1990.[1,2] These injuries carry a high disease burden: it is estimated that in the same year there were 25,8 million years lived with disability due to fractures.[3]

Older people, especially women, are at greater risk of fracture, as they tend to accumulate predisposing factors such as osteoporosis, sarcopenia, and chronic comorbidities, as well as a greater propensity to fall due to impaired balance and other physical limitations.[2]

In Latin American studies, the incidence of hip fractures (one of the most serious types of fragility fractures) varies between 40 and 360 cases per 100 000 inhabitants per year, reflecting regional differences in demographic and environmental factors. However, throughout the region, there is a trend toward an increase in these events as the proportion of older adults grows.[4] In Paraguay, although published epidemiological data are lacking, a similar situation can be inferred given the progressive aging of the population.

The consequences of fractures in the elderly are considerable. In addition to pain and functional disability, hip fractures in particular are associated with high morbidity and mortality: studies report in-hospital mortality of ~5 % and annual mortality between 20 % and 35 %. It has even been reported that up to half of patients with hip fractures may die within the first 6 months after the fracture in unfavorable clinical contexts.[5,6]

Furthermore, these injuries entail high healthcare and social costs due to prolonged hospitalizations, surgeries, rehabilitation, and loss of patient autonomy. For all these reasons, multiple international guidelines emphasize the importance of preventing fragility fractures through early identification of individuals at risk and the implementation of preventive measures (e.g., calcium/vitamin D supplementation, strengthening exercises, home modifications to prevent falls).[7]

An essential aspect is the treatment of underlying osteoporosis with pharmacological therapy when indicated, although with the precaution of avoiding overdiagnosis or inappropriate treatment in low-risk individuals. In summary, in our setting, it is a priority to study fractures in older adults in order to understand their associated factors and guide effective prevention and management strategies.[8]

This study addresses the pattern of fractures in older adults treated at a public hospital in Paraguay, describing the clinical and sociodemographic characteristics of these patients and analyzing associated factors. The objective of the study was to identify the factors associated with osteoporotic fractures in older adults at that institution during 2024, with a view to generating local information that contributes to improving prevention and care measures in this vulnerable population.

METHOD

A descriptive cross-sectional observational study was conducted, based on a review of clinical records. The target population included older adult patients (aged ≥ 60 years) with a history of bone fracture, treated at the Ingavi Surgical Specialty Hospital of the Social Security Institute (Fernando de la Mora, Paraguay) during the period from January to July 2024. All medical records that met the inclusion criteria were included consecutively (convenience sampling): patients aged 60 or older with a documented diagnosis of recent bone

fracture, treated in the Traumatology Department during the study period, with complete clinical data for the variables of interest. Cases of pathological fractures (secondary to bone neoplasms or other diseases not related to bone fragility) and those records with incomplete or illegible essential data (age, fracture diagnosis, etc.) were excluded.

An ad hoc data collection form was designed. The main variables recorded were: sociodemographic data (patient's sex and age), history of comorbidity (presence of hypertension (HT) and diabetes mellitus (DM)), anthropometric measurements (weight, height, and body mass index (BMI)), and fracture characteristics (fractured bone, type of fracture, and mechanism of injury, as well as the type of treatment received). Age was also analyzed categorized into age ranges (60–65, 66–70, 71–75, >75 years). BMI was calculated as weight/height^2 (kg/m^2) and classified according to WHO criteria: underweight (<18,5), normal (18,5-24,9), overweight (25-29,9), or obese (≥30). Fracture type was defined as closed (simple, without bone exposure) or open (exposed). The mechanism of injury was coded as: fall from own height (low-energy trauma, e.g., fall from the same level), traffic accident (vehicular, motorcycle, or pedestrian collision), or other trauma (e.g., direct blow with an object, fall from a greater height, torsion, etc.). Fracture treatment was recorded as surgical (surgical intervention: open internal reduction, osteosynthesis fixation, arthroplasty, etc.) or conservative (non-invasive orthopedic management, such as immobilization with a cast or splint).

The data collected were entered into a spreadsheet (Microsoft Excel) for processing. A descriptive statistical analysis was performed: categorical variables were summarized in absolute frequencies and percentages, presented in distribution tables. Numerical variables were described using measures of central tendency (mean, median) and dispersion (standard deviation, range). Given the purely descriptive nature of the study, no inferential tests or hypothesis comparisons were applied. All analyses were performed using Microsoft Excel® 2016.

This study was approved by the relevant institutional committee. The ethical principles of confidentiality, autonomy, and beneficence were respected: patient data were handled anonymously, solely for research purposes, and no intervention was made in medical care. As this was a retrospective study with no direct contact with patients or modification of behaviors, the risk to subjects was considered minimal.

RESULTS

One hundred older adult patients with fractures were analyzed. The average age of the sample was 76,3 ± 7,9 years, with a median of 77 (range 60 to 93 years). More than three-quarters (76 %) of the patients were 70 years of age or older, reflecting the advanced age of the cohort. In terms of gender, there was a marked predominance of females: 78 patients were female and 22 were male (ratio ~3,5:1). Table 1 presents the sociodemographic data of the sample. The mean body mass index (BMI) was 25,3 kg/m^2, corresponding to the range of slight overweight. No underweight patients (BMI <18,5) were recorded in the series studied.[9,10]

Table 1. Sociodemographic data of older adult patients with fractures (N = 100)	
Characteristic	**Result**
Age (years)	76,3 ± 7,9 (mean ± SD); median 77 (range 60-93)
Age ≥ 70 years	76 (76 %) of patients
Female	78 (78 %) of patients
Male	22 (22 %) of patients

Most patients had a BMI within the normal range (18,5-24,9) or were overweight (25-29,9); only 2 patients (2 %) were classified as obese. In terms of comorbidities, 69 patients (69 %) had high blood pressure (HBP) and 34 (34 %) had diabetes mellitus (DM)(table 2). Both conditions coincided in 28 % of the series (i.e., approximately one in three patients had both DM and HBP). All but 22 % of patients had at least one of these two chronic conditions, indicating a high associated morbidity burden in the fracture population.[10,11]

Table 3 details the main findings regarding fracture characteristics. The vast majority of fractures were closed (simple): 98 cases (98 %) of closed fractures were recorded, compared to only 1 case (1 %) of open fracture. In one patient, the type of fracture was not recorded, so it was not included in this percentage count. In other words, virtually all fractures occurred without an open wound. All fractures in the series were treated surgically (100 %); no cases were managed conservatively with casts or splints. This reflects the center's policy of recommending surgical treatment for major fractures in elderly adults, with the aim of achieving earlier mobilization.[12,13]

Regarding anatomical location, the distribution was heterogeneous but dominated by fractures in osteoporotic support bones. The most frequently affected bone was the proximal femur (hip fracture), present in 61 patients (61 % of cases). This was followed at a considerable distance by fractures of the distal radius (wrist), which

occurred in 17 patients (17 %), and those of the proximal humerus (shoulder), in 10 patients (10 %). There were few cases of leg fractures (6 % of patients with fibula fractures and 5 % with tibia fractures), and 5 % also had calcaneal (heel) fractures.

Table 2. Clinical data: comorbidities and nutritional status of patients (N = 100)		
Variable	**Category**	**N (%) of patients**
Diabetes mellitus	Yes	34 (34 %)
	No	66 (66 %)
High blood pressure	Yes	69 (69 %)
	No	31 (31 %)
BMI (category)	Underweight (<18,5)	0
	Normal weight (18,5-24,9)	46 (46 %)
	Overweight (25-29,9)	52 (52 %)
	Obesity (≥30)	2 (2 %)

Distal forearm fractures in the ulna accounted for 3 % of cases, and only 1 patient (1 %) suffered a fracture of the iliac bone (pelvis). It should be noted that some patients had multiple fractures at the same time, for example, combinations of radius and ulna, or tibia and fibula, typically in the context of higher-energy trauma. In such cases, the same patient was counted in more than one anatomical site, so that the sum of the location percentages exceeds 100 %. No vertebral (spine) fractures were recorded in the present series, possibly because these cases did not reach the trauma service or were managed by another specialty.

Table 3. Characteristics of fractures: affected bone, mechanism of injury, type of fracture, and treatment (N = 100)		
Variable	**Category**	**n (%) of patients**
Fractured bone	Femur (proximal) hip	61 (61 %)
	Radius (distal) wrist	17
	Humerus (proximal) shoulder	10
	Fibula leg	6
	Tibia leg	5
	Calcaneus heel	5
	Ulnar forearm	3 (3 %)
	Ilium pelvis	1 (1 %)
Fracture mechanism	Fall from own height (low energy)	84 (84 %)
	Traffic accident	8
	Other trauma	7 (7 %)
Type of fracture	Closed (simple)	98 (98 %)
	Open (exposed)	1 (1 %)
Treatment	Surgical (surgery)	100 (100 %)
	Conservative (cast/splint)	0 (0 %)

The predominant mechanism of injury was clearly a fall from standing height. In 84 patients (84 %), the fracture resulted from an accidental fall from standing height (tripping or slipping on the same plane, typically at home). Traffic accidents were the second most frequent mechanism, but by a wide margin: only 8 cases (8 %) were attributable to vehicular incidents (either car accidents, motorcycle falls, or pedestrian collisions). Other various traumas were observed in 7 patients (7 %) and included mechanisms such as direct blows with heavy objects, falls from a greater height (e.g., falling from a ladder), or sudden twists. In 1 patient (1 %), the mechanism of the fracture could not be clearly determined from the medical history (data not recorded). Excluding this isolated case without data, nearly 85 % of fractures with a known mechanism were due to low-energy falls, reaffirming that the main etiology was related to bone fragility. Table 3 summarizes the percentage distribution according to mechanism, while figure 1 graphically illustrates the relationship between the nutritional status (BMI) of patients and the type of fracture suffered.
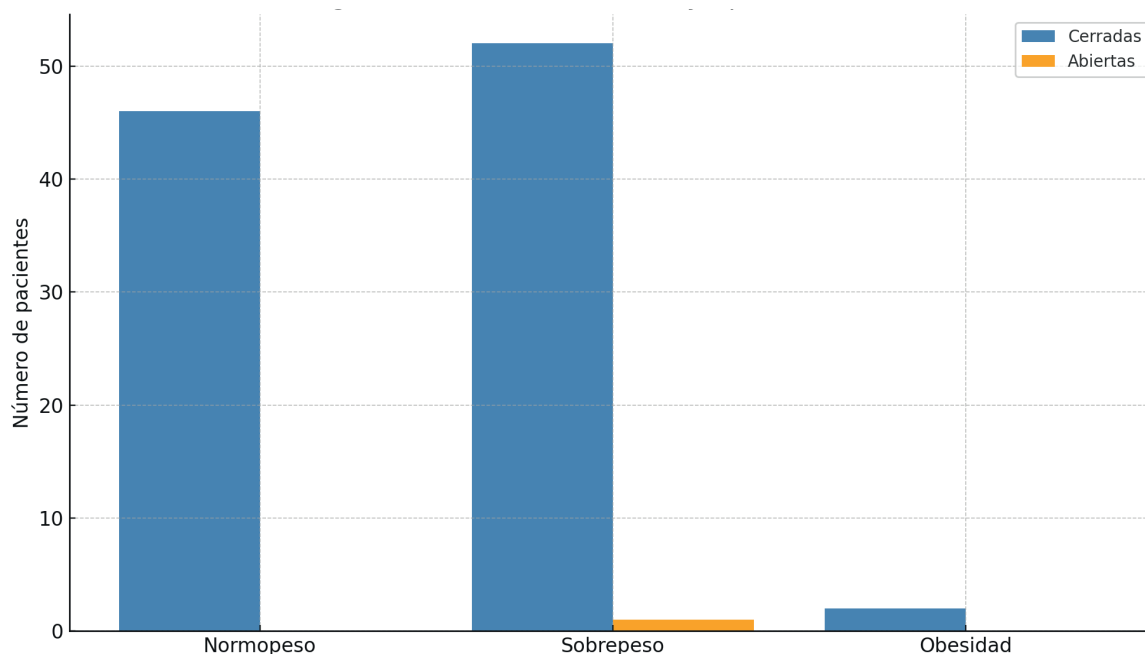
Figure 1. Relationship between body mass index (BMI) and type of fracture

The bar chart compares, for each BMI category, the number of patients who suffered a closed fracture vs. an open fracture. It can be seen that in all nutritional categories, closed fractures (blue bars) predominated overwhelmingly, with only one isolated case of open fracture (orange bar) in the overweight category. No underweight patients had fractures (BMI category <18,5 empty). These results indicate that, regardless of BMI (whether normal weight, overweight, or obese), fractures in older adults were almost always closed, reflecting their low-energy mechanism. The only open fracture occurred in an overweight patient involved in a high-energy trauma, confirming that open fractures were exceptional in this cohort.

DISCUSSION

This study characterized osteoporotic fractures in Paraguayan older adults, finding patterns consistent with those reported in other populations. The average age of 76 years and the marked predominance of females (78 %) are consistent with the global epidemiology of fragility fractures. International studies have documented that about three-quarters of fractures in the elderly occur in women. For example, in a Colombian cohort of patients with hip fractures (n=155), 74,8 % were women and the average age was 81,6 years.[1,14]

Our sample included a slightly younger proportion (median age 77 years), probably because we considered not only hip fractures but also wrist and proximal humerus fractures, which tend to occur in active septuagenarians, unlike hip fractures, which typically affect more fragile octogenarians. Nevertheless, this is clearly a geriatric group in which multiple fracture risk factors coexist.

Chronic comorbidity was highly prevalent in our patients: 69 % had high blood pressure and 34 % had diabetes mellitus, proportions slightly higher than those reported in some studies. For example, in a Cuban series of older adults with hip fractures, hypertension was present in 58 % of cases. In Spain, hypertension has been reported in around 32 % of these patients, although this figure may underestimate the total burden of comorbidities if other associated conditions are considered.[5]

In general, more than 80 % of elderly people with fractures have at least one concomitant chronic disease, with cardiovascular (particularly hypertension) and endocrine-metabolic (diabetes) diseases being the most common. This high prevalence is consistent with our findings and highlights the clinical complexity of these patients. Diabetes mellitus (DM), in particular, has been identified as a factor that increases the risk of fragility fractures. Studies have shown that people with diabetes—even those with type 2 diabetes, who tend to have normal or high bone mineral density—are at increased risk for osteoporotic fractures. Microvascular complications of diabetes (such as retinopathy and peripheral neuropathy) increase the propensity to fall, contributing to this risk. In our series, approximately 1 in 3 patients was diabetic, reinforcing the need for optimal glycemic control and the inclusion of fall and fracture risk assessment in the comprehensive management of elderly diabetic patients.

High blood pressure (HBP) was found in two-thirds of our patients. Although the causal relationship between HBP and osteoporosis is not fully understood, there is evidence of an association between the two conditions. Recent studies suggest that hypertension may lead to decreased bone remodeling (low turnover), which could

be a mechanism of HBP-related osteoporosis.[10]

Likewise, certain antihypertensive drugs could increase the risk of falls due to orthostatic hypotension, favoring fractures. Butt et al. reported that the initiation of antihypertensive therapy in older adults is associated with a significant increase in the risk of hip fracture in the short term. Therefore, the high percentage of hypertensive patients in our cohort suggests that it is important to exercise caution when managing blood pressure in frail elderly people, avoiding sudden drops that could precipitate falls, and to investigate in future studies the possible direct relationship between hypertension, its treatments, and bone health.[9]

Regarding the mechanism of injury, our data confirm that low-energy falls are by far the most common cause of fractures in older adults. Eighty-four percent of cases resulted from falls from standing height, a figure very similar to the 83–85 % reported in hip fracture series in elderly people from different countries.[2] This confirms that most of these fractures can be considered fragility fractures linked to osteoporosis: they occur with minimal trauma that would not cause bone rupture in young adults. In contrast, high-energy trauma (e.g., traffic accidents) accounted for less than 10 % of fractures in our series, generally corresponding to the few cases of open fractures or atypical locations.

It is worth mentioning that we did not record any vertebral fractures, despite the fact that, globally, spinal fractures are among the most frequent locations in osteoporosis. This could be because many fragility vertebral fractures are not diagnosed (due to mild symptoms or outpatient management) or because of differences in care pathways (e.g., patients with vertebral fractures may consult with clinicians or rheumatologists rather than traumatologists). Regardless, our main locations (hip, wrist, and proximal humerus) are consistent with the typical fragility fractures described in the global literature. For example, the World Health Organization notes that the most common sites of fragility fractures are the hip, wrist (distal radius), proximal humerus, and vertebrae, precisely the predominant sites observed in our cohort.[1]

It is noteworthy that 100 % of our patients were treated surgically, including hip fractures (with osteosynthesis or arthroplasty) and fractures at other sites. This reflects current best practices, given that early surgical treatment of hip fractures in the elderly is associated with better functional outcomes and lower mortality compared to delayed or conservative management.[15]

In our series, there were no cases managed with casts, unlike what might occur in some non-displaced wrist or humerus fractures; possibly the surgical indication was extended to allow for faster mobilization and to avoid complications from prolonged bed rest. Rapid surgical resolution (ideally within the first 48 hours) is recommended in international guidelines to reduce complications and improve recovery in hip fractures, in line with the policy adopted in our center.[16]

Among the limitations of this study are its descriptive nature and single-center setting. The sample size (100 patients) is relatively small; although sufficient to observe trends, it may not capture all possible scenarios. Furthermore, as this is a retrospective analysis of medical records, the data depend on the quality of the medical records. In fact, there were cases with missing information (for example, one patient without specification of the type of fracture, another without clarification of the mechanism), which highlights the need to improve clinical documentation.

 It was also not possible to evaluate some factors of interest, such as a history of diagnosed osteoporosis or pharmacological treatment for it, as this data was not systematically recorded in the records. This prevented further investigation into the proportion of patients receiving preventive treatment or adherence to anti-osteoporotic therapies prior to the fracture. Furthermore, vertebral fractures and hip fractures treated outside the surgical setting were not included, which could underestimate the total burden of fragility fractures (especially vertebral fractures, which often do not require surgery).[17]

Despite the above, the results obtained are consistent with international evidence and provide valuable local information. To our knowledge, this is the first detailed report on fractures in older adults in a public hospital in Paraguay, which is a strength of the study. The findings can serve as a basis for initiatives to improve geriatric care and fracture prevention.

Our observations confirm that osteoporotic fractures in older Paraguayan adults predominantly affect elderly women with frequent comorbidities (hypertension, diabetes) and are mainly caused by low-energy falls in classic sites of bone fragility (hip, wrist, humerus). These patterns reflect global trends and underscore the urgency of implementing comprehensive prevention strategies.

It is essential to strengthen fall prevention programs in the home and community settings, as well as to optimize the detection and treatment of osteoporosis in primary and specialized care. Simple measures such as calcium and vitamin D supplementation have been shown to improve bone density in people over 65, and together with exercise and rehabilitation interventions, they can help reduce the risk of fractures. At the same time, the indication for anti-osteoporotic drugs should be individualized to avoid both undertreatment in high-risk patients and overtreatment in low-risk patients.[11,12,16]

It is advisable to establish post-fracture follow-up clinics or programs (a "fracture liaison service" approach) to ensure that every elderly patient with a fracture receives evaluation and secondary preventive management of bone fragility, thus avoiding new fractures in the future. In short, addressing this problem

from a multidisciplinary perspective (integrating traumatology, geriatrics, family medicine, rehabilitation, and public health) will enable us to tackle the "hidden epidemic" of fragility fractures in our aging population, improving the quality of life of older adults and reducing the associated social and healthcare burden.

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CONFLICT OF INTEREST
The authors declare that there is no conflict of interest in the execution of this study or in the preparation of this manuscript.

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