ORIGINAL RESEARCH

Sociodemographic, clinical, and radiological characteristics of women over 50 years of age with distal radius fractures due to bone fragility treated at a hospital in Medellín, Colombia

Características sociodemográficas, clínicas y radiológicas de mujeres mayores de 50 años con fracturas de radio distal por fragilidad ósea atendidas en un hospital de Medellín, Colombia

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Abstract

Introduction: Distal radius fractures due to bone fragility are common in postmenopausal women and, in many cases, are the first sign of poor bone health. In Colombia, the characteristics of patients in this age group are unknown.

Objective: To describe the sociodemographic, clinical, and radiological characteristics of women over 50 years of age with distal radius fractures due to bone fragility treated at a university hospital in Medellín, Colombia.

Methodology: Retrospective observational study conducted in 103 women ≥50 years with distal radius fracture (108 fractures) treated between January 2020 and December 2021 at a university hospital in Medellín, Colombia. The AO Foundation and Orthopaedic Trauma Association (AO/OTA) classification system was used to determine the type of fracture.

Results: The mean age of the participants was 66.63 years (SD: 11.16 years), and 55.56% (n=60) of the fractures were treated surgically (palmar locking plate fixation). The most common risk factors for fragility fractures were history of fractures (16.50%) and active smoking (12.62%). Type C fractures were the most frequent (54.63%; n=59), followed by type A fractures (29.63%; n=32). Complications were reported in 10 patients (9.70%), the most frequent being adhesion of the flexor tendons of the hand (n=3).

Conclusion: Most fractures were treated surgically (palmar locking plate fixation) and type C fractures (AO/OTA classification) were the most frequent. The most common risk factors for fragility fracture were a history of fracture and active smoking.

Keywords: Radius Fractures; Osteoporotic Fractures; Osteoporosis; Wrist Fractures (MeSH).

Resumen

Introducción. Las fracturas de radio distal son frecuentes en mujeres posmenopáusicas y, en muchos casos, son la primera manifestación de una salud ósea pobre. En Colombia, las características de estas pacientes son desconocidas.

Objetivo. Describir las características sociodemográficas, clínicas y radiológicas de mujeres mayores de 50 años con fracturas de radio distal por fragilidad ósea atendidas en un hospital universitario de Medellín, Colombia.

Metodología. Estudio observacional retrospectivo realizado en 103 mujeres ≥50 años con fractura de radio distal (108 fracturas) atendidas entre enero de 2020 y diciembre de 2021 en un hospital universitario de Medellín, Colombia. Se utilizó el sistema de clasificación AO Foundation/Orthopaedic Trauma Association (AO/OTA) para determinar el tipo de fractura.

Resultados. La edad promedio de las participantes fue 66,63 años (DE: 11,16 años) y 55,56% (n=60) de las fracturas fueron tratadas quirúrgicamente (fijación con placa palmar bloqueada). Los factores de riesgo de fracturas por fragilidad más frecuentes fueron antecedentes de fracturas (16,50%; n=17) y presencia de tabaquismo (12,62%; n=13). Las fracturas tipo C fueron las más comunes (54,63%; n=59), seguidas por las de tipo A (29,63%; n=32). Además, se reportaron complicaciones en 10 pacientes (9,70%), siendo la más frecuente la adherencia de los tendones flexores de la mano (n=3).

Conclusiones. La mayoría de las fracturas fueron tratadas quirúrgicamente (fijación con placa palmar bloqueada) y las fracturas tipo C (clasificación AO/OTA) fueron las más frecuentes. Los factores de riesgo de fractura por fragilidad más comunes fueron el antecedente de fractura y la presencia de tabaquismo.

Palabras clave: Fracturas del radio; Fracturas osteoporóticas; Osteoporosis, Fracturas de la muñeca (DeCS).
Introduction

Fragility fractures are caused by low-impact trauma forces. They are often the first manifestation of poor bone health in patients with osteoporosis and affect mainly postmenopausal women. This type of fracture is associated with increased morbidity and mortality and poses a significant economic burden on healthcare systems.

The prevalence of fragility fractures of the distal radius in postmenopausal women is high worldwide, reaching its highest incidence between the ages of 64 and 94 years. Moreover, these injuries are the third most common type of fragility fracture after vertebral and hip fractures, and represent the second most frequent low-energy trauma fracture. An association between age and the complexity of bone fragility fractures of the distal radius has also been described.

The risk of fragility fractures depends on the combination of several factors, the most relevant being osteoporosis, which implies low bone mineral density and alteration of bone microarchitecture. However, other modifiable and non-modifiable risk factors have been identified, including estrogen deficiency, menopause, vitamin D and calcium deficiency, low body mass index (BMI), active smoking, sedentary lifestyle and frequent falls among the modifiable risk factors, and increasing age, being female, Caucasian, history of fragility fracture, among others, as non-modifiable risk factors.

The management of fragility fractures can be conservative, immobilizing the affected area until fracture healing is achieved, or surgical, involving various approaches and reduction and fixation techniques, with open reduction and fixation with palmar plates being the most commonly used at present. Choosing between these two types of management depends on risk factors, the availability of resources, the experience and preference of the treating specialist, as well as the specific conditions of the patient or even public health events. This was demonstrated during the COVID-19 pandemic, when the number of patients receiving conservative management increased in some regions and the use of remote follow-up strategies with the help of technologies, such as telemedicine, increased.

Few studies in Colombia describe the characteristics of postmenopausal women with fragility fractures of the distal radius. Therefore, the objective of the present study is to describe the sociodemographic, clinical, and radiological characteristics of women over 50 years of age with fragility fractures of the distal radius treated at a university hospital in Medellín, Colombia.

Methodology

Study type

Descriptive and retrospective observational study.

Study population and sample

The study population consisted of women with fractures of the distal radius treated between January 2020 and December 2021 at the Hospital Universitario San Vicente Fundación in Medellín, Colombia (N=262). It should be noted that the orthopedics service of this hospital provides healthcare to highly complex patients of all socioeconomic levels in the department of Antioquia.
The following inclusion criteria were considered: being over 50 years of age, having a distal radius fracture caused by low-energy trauma (defined as a fall from a standing height or lower), and having a record in the institution’s radiology system of the X-rays taken during the acute phase of the fracture. Once the inclusion criteria were verified, a sample of 103 women (108 fractures) was obtained (Figure 1).

**Procedures and variables**

Based on the review of the medical records of each patient, information was collected on the sociodemographic variables age, place of origin, and healthcare regime. Data were also collected on the risk factors for fragility fractures, i.e., history of fractures, presence of osteoporosis or osteopenia according to bone densitometry, presence of rheumatoid arthritis, calcium deficiency, vitamin D deficiency, chronic use of steroids (consumption of prednisolone or its equivalent in doses >5mg/day for at least 3 months), and active smoking and consumption of alcoholic beverages (daily consumption, regardless of the amount).

Also, X-rays were obtained from the hospital radiology system and subsequently evaluated by one of the authors (an orthopedic hand and upper limb expert) to establish the type of fracture as classified by the AO Foundation/Orthopaedic Trauma Association (AO/OTA). Likewise, the patients’ follow-up visit records up to the date of data collection (December 2022) were reviewed in order to obtain information on treatment, osteosynthesis material used, and occurrence of associated complications.

**Statistical analysis**

All data were entered into a database created in Microsoft Excel for subsequent analysis in the IBM SPSS Statistics software (version 28.0.1). Data are described using absolute and relative frequencies for qualitative variables and means and standard deviations (SD) for quantitative variables according to the distribution of the data (Kolmgorov-Smirnov test).
Ethical considerations

This research followed the ethical principles for conducting biomedical studies involving human subjects established in the Declaration of Helsinki, the basic bioethical principles established in the Belmont Report and set forth by Beauchamp and Childress, as well as the scientific, technical and administrative standards for health research of resolution 8430 of 1993 of the Colombian Ministry of Health and Social Protection. Moreover, the study was approved by the Ethics Committee of the Hospital San Vicente Fundación de Medellín by means of minutes 35-2022 of December 16, 2022, and, since the data were taken directly from the medical records, informed consent was not required from the patients.

Results

The mean age of the patients was 66.63 years (SD: 11.16 years), the most frequent place of origin was the urban area of the Aburrá Valley (88.35%; n=91), and 52.43% (n=54) were enrolled in the subsidized healthcare system. Table 1 presents the sociodemographic characteristics of the participants.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Place of origin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aburrá Valley</td>
<td>91</td>
<td>88.35</td>
</tr>
<tr>
<td>Nearby municipalities</td>
<td>7</td>
<td>6.80</td>
</tr>
<tr>
<td>Remote municipalities</td>
<td>3</td>
<td>2.91</td>
</tr>
<tr>
<td>Other departments</td>
<td>2</td>
<td>1.94</td>
</tr>
<tr>
<td><strong>Healthcare system enrollment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contributory regime</td>
<td>45</td>
<td>43.69</td>
</tr>
<tr>
<td>Subsidized regime</td>
<td>54</td>
<td>52.43</td>
</tr>
<tr>
<td>Compulsory traffic accident insurance</td>
<td>3</td>
<td>2.91</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
<td>0.97</td>
</tr>
</tbody>
</table>

On the other hand, 16.50% of the patients (n=17) had a history of fractures, with hip fracture being the most frequent (64.70%; n=11), followed by distal radius fracture (17.64%; n=3) (Figure 2).

![Figure 2. Anatomical site of previous fractures. Source: Own elaboration.](https://doi.org/10.58814/01208845.64)
In addition to a history of fractures, being an active smoker (12.62%; n=13) and the presence of osteoporosis or osteopenia (8.73%; n=9) were the most frequent risk factors for fragility fractures (Table 2). It should be noted that only 9 patients (8.73%) had information on bone densitometry in their medical records, of whom 8 had osteoporosis and 1 had osteopenia.

Table 2. Risk factors for fragility fractures in the women included in the study (n=103)

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of fragility fractures</td>
<td>17</td>
<td>16.5</td>
</tr>
<tr>
<td>Active smoking</td>
<td>13</td>
<td>12.62</td>
</tr>
<tr>
<td>Osteoporosis or osteopenia</td>
<td>9</td>
<td>8.73</td>
</tr>
<tr>
<td>Use of corticosteroids</td>
<td>4</td>
<td>3.88</td>
</tr>
<tr>
<td>Vitamin D deficiency</td>
<td>4</td>
<td>3.88</td>
</tr>
<tr>
<td>Calcium deficiency</td>
<td>4</td>
<td>3.88</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>3</td>
<td>2.91</td>
</tr>
<tr>
<td>Active alcohol use</td>
<td>1</td>
<td>0.97</td>
</tr>
</tbody>
</table>

Source: Own elaboration.

Regarding the AO/OTA classification of the 108 fractures included in the study (Figure 3), 29.63% (n=32) were classified in group A (extra-articular fracture); 15.74% (n=17), in group B (partial articular fracture); and 54.63% (n=59), in group C (complete articular fracture).

Figure 3. Type of distal radius fracture (n=108).
Source: Own elaboration.

Regarding the distribution of fracture type by age group (50-69 years vs ≥70 years), it was found that 57.14% (n=40) of the fractures in the 50-69 years age group (n=70) were type C, 28.57% (n=20) were type A, and 14.29% (n=10) were type B. As for the group aged ≥70 years (n=38), 47.37% (n=18) of the fractures were type C, 34.21% (n=13) were type A, and 18.42% (n=7) were type B. Furthermore, of the 8 patients with osteoporosis or osteopenia, 6 had type C fractures. Regarding management, 55.56% (n=60) of the fractures were treated surgically (locking palmar plate fixation), with the majority being type C (n=37; 62.71%) (Table 3).
Table 3. Distribution of fractures according to the AO/OTA classification and type of management (n=108)

<table>
<thead>
<tr>
<th>AO/OTA classification</th>
<th>Type of management</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-surgical</td>
<td>Surgical</td>
</tr>
<tr>
<td>A (n=32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>B (n=17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>C (n=59)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>60</td>
</tr>
</tbody>
</table>

Source: Own elaboration.

Finally, 9.52% (n=10) of the patients presented some complication, the most frequent being flexor tendon adhesion (n=3), fracture malunion (n=2), and complex regional pain syndrome (n=2) (Table 3). It is worth noting that only one of the patients with complications (fracture malunion) had received non-surgical treatment.

Table 4. Distribution of fractures (AO/OTA classification) by presence of complications (n=108).

<table>
<thead>
<tr>
<th>Complication</th>
<th>AO/OTA classification</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A 1 2 3</td>
<td>B 1 2 3</td>
</tr>
<tr>
<td></td>
<td>C 1 2 3</td>
<td></td>
</tr>
<tr>
<td>Rupture of extensor pollicis longus tendon</td>
<td>- - 1 -</td>
<td>- - - 1</td>
</tr>
<tr>
<td>Fracture malunion</td>
<td>- - - -</td>
<td>1 - 2</td>
</tr>
<tr>
<td>Tenosynovitis of the extensor tendons of the hand</td>
<td>- - - -</td>
<td>- - 1 1</td>
</tr>
<tr>
<td>Complex regional pain syndrome</td>
<td>- - - -</td>
<td>1 1 2</td>
</tr>
<tr>
<td>Flexor tendon adhesion</td>
<td>- - - -</td>
<td>2 1 3</td>
</tr>
<tr>
<td>Complications associated with articular screws</td>
<td>- - - -</td>
<td>- - 1 1</td>
</tr>
<tr>
<td>Total</td>
<td>0 0 1 0</td>
<td>0 6 2 10</td>
</tr>
</tbody>
</table>

Source: Own elaboration.

Discussion

Distal radius fractures restrict activities of daily living, are associated with low morbidity, and are not directly related to increased mortality. Additionally, it is important to consider them as a sentinel injury that warns of the risk of subsequent and potentially serious fractures. It has been reported that the risk of suffering a distal radius fracture in women over 50 years of age is 15% and that the incidence of this type of fracture increases significantly in postmenopausal women, reaching a peak between 60 and 70 years of age with 300-400 cases per 100 000 people.

The most frequent risk factor for fragility fractures in this study was a history of fractures (16.50%; n=17), which is the most clinically important factor; in addition, 3 patients presented another fracture concomitantly. Dewan et al., in a prospective cohort of 113 patients with fragility fractures of the distal radius comprising mostly women (88%) with a mean age of 62 years and an average follow-up time of 4 years, found that
24% reported at least one subsequent fall and 19% had at least one subsequent fracture. In turn, Albrand et al.\textsuperscript{29} reported that, in healthy postmenopausal women, personal history of fragility fracture was an independent predictor of osteoporotic fractures \textit{(odds ratio [OR]: 3.33; confidence interval [CI]: 1.75-5.66)}. Similarly, Cuddihy et al.\textsuperscript{30} described that women with a history of a forearm fragility fracture had a risk of another “classic” osteoporotic fracture (hip, vertebra, forearm, humerus, or pelvis) 3 times higher than the expected rate for the general population in the community they studied. Similarly, Niempoog et al.\textsuperscript{9} stressed the need to identify fragility-associated fractures to prevent more serious injuries in the future. The International Osteoporosis Foundation has termed this sequential occurrence of fractures due to decreased bone quality as “osteoporotic career”\textsuperscript{31} and therein lies the importance of detecting the first fracture in order to provide comprehensive management to reduce the risk of new fractures.

In this study, other risk factors identified were active smoking (12.62%), chronic corticosteroid use (3.88%), calcium deficiency (3.88%), and vitamin D deficiency (3.88%). With respect to tobacco use, Huo et al.\textsuperscript{32} reported that being a smoker is associated with an increased prevalence of osteoporosis or osteopenia and, consequently, with an increased risk of fragility fractures. Regarding calcium and vitamin D deficiencies, a meta-analysis by Weaver et al.\textsuperscript{33} including 8 randomized controlled trials (30 090 patients) found that calcium plus vitamin D supplementation statistically significantly reduced by 15% the risk of total fractures and by 30% the risk of hip fractures, supporting the use of supplementation in this population. In contrast, Reid et al.\textsuperscript{34} concluded that supplementation with calcium, vitamin D or their combination does not prevent fractures in healthy adults, and that the efficacy and safety of antiresorptive therapy for osteoporosis does not require supplementation, except for patients with risk factors that require treatment or prevention of vitamin D deficiency; furthermore, according to these authors, severe vitamin D deficiency (<25 nmol/L) should be corrected before the use of potent antiresorptive drugs to avoid hypocalcemia.\textsuperscript{34}

In the present study, complex fractures were more frequent in the age group of women between 50 and 69 years than in those ≥70 years; moreover, 70.37% of the fractures were type B or C in the AO/OTA classification (type B: 15.74%; n=17 vs type C: 54.62%; n=59). This may suggest a relationship between bone quality and more complex fracture traces; however, evidence in this regard is scarce and inconclusive. For example, Hjelle et al.\textsuperscript{35} found that distal radius fracture patients with osteoporosis did not have more complex fractures than those with osteopenia according to the AO classification system. Additionally, Daniels et al.\textsuperscript{11} studied the association of distal radius fracture pattern complexity with characteristics (including tobacco and alcohol use) of patients aged 50-90 years of both sexes, bone mineral density, bone microarchitecture and bone strength, using the AO/OTA classification, and reported that only male sex (OR: 8.48; 95%CI: 1.75-41.18; p=0.008) and age (OR: 1.11; 95%CI: 1.03-1.19; p=0.007) were significantly associated with the presence of complex fracture patterns. Finally, Dhainaut et al.\textsuperscript{36} evaluated 110 women ≥50 years with distal radius fractures, finding a weak association between low bone mineral density and dorsal angulation and ulnar variance, but not with fracture trace complexity in the AO/OTA classification.

Regarding treatment choice (surgical vs non-surgical), 55.56% of patients underwent surgery. It should be kept in mind that our study period was framed within the COVID-19 pandemic, and for this reason, between March and December 2020, restrictions on human mobility and biosecurity measures were implemented, which were partially lifted in 2021.\textsuperscript{21,22} The declaration of a health emergency due to the pandemic could explain the significant percentage of patients with complex joint fractures (group C) treated...
non-surgically, in which the low occurrence of complications is striking. In a prospective cohort study by Thorninger et al. in 90 patients, good outcomes were reported in both patients with displaced fractures and those with minimally displaced fractures treated with plaster cast, with a complication frequency of 16.6% and 6.3%, respectively.

Locking palmar plate fixation, which has been increasingly used in the treatment of distal radius fractures since its inception, was used in all patients who received surgical treatment in the present study; in addition, complications related to the flexor and extensor tendons occurred mainly in patients with type C fractures. In this regard, such complications have also been reported in the literature. In the study conducted by DeGeorge et al. in 647 cases of distal radius fractures, a low incidence of complications and risk factors associated with complications (diabetes, obesity, among others) and intraoperative factors (joint reduction, plate prominence, etc.) were found. On the other hand, Pidgeon et al., in a study conducted in 39 patients operated on using a volar locking plate, reported that complications included discomfort with the implant, defective consolidation and tendon rupture, and occurred more frequently in patients with type C fractures in the AO classification. Concerning flexor tendon-related complications, Floquet et al. reported in a systematic review (46 studies) that plate impingement and prominent screws were the most common flexor tendon rupture injury mechanisms, while Kunes et al. reported based on a systematic review (90 studies) that extensor tendon injury has a variable prevalence (0%-12.5%), with extensor pollicis longus rupture being the most frequent.

The limitations of the present study include its retrospective nature, as it is based on a review of medical records, which implies an information bias because it is not possible to ensure that information related to risk factors is available in all cases. Moreover, not all cases of fragility fractures of the distal radius in women treated at the hospital were included since not all of them had X-rays available in the radiology system of the institution. Finally, it is possible that the COVID-19 pandemic may have influenced the preference for surgical management.

With respect to the strengths of the study, we can highlight the importance of the research topic, since the fragility fracture risk factors included should be detected early in these patients and considered when creating and implementing programs for the prevention of subsequent fractures. Finally, it is important to note that in the institution where this study was developed, the program promoted by the International Osteoporosis Foundation for the secondary prevention of new fragility fractures is being implemented.

**Conclusions**

In the present study, the most common fragility fracture risk factors were a history of fracture and active smoking in women <50 years with distal radius fracture. Furthermore, most of the fractures were type C according to the AO/OTA classification and surgical treatment (fixation with locking palmar plates) was the most common. The most frequent complications were flexor tendon adhesion, malunion and complex regional pain syndrome, which occurred mainly in patients who underwent surgery, especially those with type C fractures. In this sense, it is important to timely identify the risk factors for osteoporosis in this population, as well as to diagnose this disease early, as this will allow for a timely treatment, reducing the risk of associated complications, which in turn will positively impact the quality of life of these patients.
Conflicts of interest

None stated by the authors.

Funding

None stated by the authors.

Acknowledgments

The authors would like to express their gratitude to the Faculty of Medicine of the Universidad de Antioquia and the Hospital San Vicente Fundación for making this research possible.

References


