Epidemiology of osteoporotic fractures. Mortality and morbidity

Introduction
The osteoporotic fracture has an enormous economic impact, in addition to its effects on health. In the year 2000, it was estimated that there were 4 million new fractures in Europe – some 8 fractures per minute, or one fracture every 8 seconds. Of these, 0.89 million were hip fractures. The direct costs have been estimated at nearly 32 billion euros, which it is expected will increase to 77 billion euros by 2050 as a function of demographic changes expected in Europe.

The combined risk of suffering hip, forearm and clinical vertebral fractures is approximately 40%, similar to that of developing cardiovascular disease. In Caucasian women, the risk of hip fracture over their lifetime is 1/6, higher than that of suffering breast cancer -1/9-. In our country it is calculated that 2 million women have osteoporosis, putting its prevalence at 26.1% of women over 50 years of age. More than 25,000 fractures appear annually, from which originate direct costs of more than 126 million euros, with indirect costs reaching 420 million euros annually.

Incidence and prevalence
The incidence of fractures is bimodal, with peaks in young people and in older people. In young people the predominant fractures are of the large bones, normally after intense trauma, and with greater frequency in males. Although in this group bone resistance is not usually in question, the available data show that this factor may play some role in its pathogenicity. From 35 years of age, the incidence of fractures in women ascends gradually until it is double that of males. Before the availability of studies which assessed radiographic vertebral fractures in place of clinical fractures, it was thought that this peak was due to fractures of the hip and forearm. These studies have proved that vertebral fractures contribute significantly to this incidence (Figure 1).

Fracture of the hip
In most populations the incidence of hip fracture increases exponentially with age (Figure 1). From the age of 50, the women to man ratio approximates to 2 to 1. In conjunction with this, 98% of hip fractures appear in people over the age of 35 years and 80% in women (given that women predominate in later years). Most occur after a fall from a height equal to or less than their own.

Recent studies of the database of the General Practitioners of the United Kingdom (General Practice Research Database, GPRD), which includes 6% of the population, has characterised the incidence of fractures adjusted for age and sex. The global risk of hip fracture from 50 year of age in the United Kingdom is 11.4% and 3.1% for women and men, respectively. The greater part of this risk accumulates in the more advances ages in such a way that the risk of suffering a hip fracture in the following 10 years at 50 is 0.3% while at 80 years the risk is 8.7% - in the case of males 0.2% and 2.9% respectively.

Hip fractures have a seasonal influence, with a higher incidence in the winter, even though they occur principally in people’s homes, which seems to suggest that this is due to worse conditions of illumination or a slowing of neuromuscular refle-
Figure 1. Incidence of fractures of the hip, radiographic vertebral and forearm, according to age and sex (adapted from refs 17 and 15)

![Graph showing incidence of fractures of the hip, radiographic vertebral and forearm](image)

- Male
- Female

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<th>Age (years)</th>
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The direction and way of falling is significant, with a lateral fall directly on the hip more likely to cause a fracture than a frontal forward fall. The incidence varies substantially from one population to another and is usually higher in Caucasians than in other races. Across Europe, the proportion of hip fractures varies up to 7 times between different countries, with our country being among those with a low incidence, and Norway, Sweden, Iceland, Denmark and the USA considered to have a high incidence. Thus, environmental factors have an important role in the aetiology of hip fractures, although those studied to date – smoking, alcohol consumption, physical activity, ethnic origin and/or migratory status – have not completely explained these differences.

In our country, a retrospective study which assessed 13,195 hip fractures found a clear dominance of the female sex (74%) with an average age of 80.7 ± 8.4 years. The average incidence was 6.94 ± 0.44 fractures of the hip for each 1,000 inhabitants per year. The prospective study from this same work found a monthly prevalence of 0.60 ± 0.04 fractures per 1,000 inhabitants with 74% being women and an average age of 81.4 ± 8.1 years. The authors conclude that the average prevalence in 2003 was 7.20 fractures per 1,000 inhabitants, of whom a third had suffered a previous hip fracture and only 18% having previously received medical treatment for osteoporosis.

**Vertebral fracture**

The data from the European Vertebral Osteoporosis Study (EVOS) have shown over recent years that the standardised prevalence by age for vertebral fracture in Europe is 12.2% for men and 12.0% for women between 50 and 79 years of age. The prevalence of fractures by age and sex in this population are shown in Figure 2. Although classically, it had been thought that vertebral fractures were more common in men than in women, the data from the EVOS study show that this is not so at younger ages; the prevalence of deformities at between 60 and 75 years is similar, or even higher in men, possibly due to a higher incidence of traumas. The majority of vertebral fractures in older women happen in daily activities such as picking up or lifting objects more than because of falls. Many vertebral fractures are asymptomatic and, what is more, there is no unanimous agreement regarding the radiographic definition of vertebral deformities. In studies which use radiographic screening, the incidence of vertebral deformities has been estimated as being three times those of the hip, although only a third of those result in a medical consultation. The data from the EVOS study have allowed a more precise assessment of radiographic vertebral fractures in a broad population. Between the years of 75 and 89, the incidence of vertebral fractures is 13.6 per 1,000 inhabitant years in men and 29.3 per 1,000 person years for women, which is clearly higher than the 0.2 per 1,000 person years in men and 9.8 per 1,000 person years assessed in people between 75 to 85 years defined through clinical presentation in an earlier study in the US. The standardised global incidence from the EVOS study was 10.7 per 1,000 person years in women and 5.7 per 1,000 person years in men.

From the comparison of the population data available, it is evident that the heterogeneity of the prevalence of vertebral fractures is much lower than that found in fractures of the hip. This contrasts with the much lower variability between populations of vertebral fractures identified by clinics or through hospitalisation.

**Distal forearm fracture**

The Colles fracture has a presentation profile different from that of the hip and the vertebrae. There is an increase in the incidence in Caucasian women between 45 and 60 years of age followed by a plateau, which has been related to a change in neuromuscular reflexes caused by aging, and by a tendency to suffer lateral or backward falls whose impact they are attempted to avoid or cushion with the arms extended. The majority of these wrist fractures appear in women and more than 50% appear in women over 65 years of age. The GPRD database shows a risk of vital fracture in women of 50 years of age of 16.6%, whilst at 70 years this risk falls to 10.4%. The incidence in males is significantly lower and does not change excessively with age (rest of life risk of 2.9% at 50 years and 1.4% at 70 years).
Temporal projections
The progressive aging of the population, especially in the western world, but also in developing countries, will produce a spectacular increase in the number of osteoporotic fractures. In fact, between 1990 and 2000, a worldwide increase in hip fractures of 25% was reported. The peak for the presentation of hip fractures appears at 75-79 years of age in both sexes; for the other fractures the peak appears at 50-59 years and reduces with age. For 2050, the projection of the incidence of vertebral fractures is predicted to increase by 310% in males and 240% in women.

Tendency to the aggregation of fractures in individuals
In different epidemiological studies it has been suggested that patients with fragility fractures have an increased risk of developing other types of fractures. Thus, for example, a previous vertebral deformity increases from 7 to 10 times the risk of developing later vertebral deformities. The risk of suffering a second hip fracture is also increased by a similar magnitude. North American data show an increased risk of hip fracture of 1.4 times in women and of 2.7 times in men after suffering a Colles fracture. The increased risk of a later vertebral fracture in the same cohort is 5.2 and 10.7 times. The EVOS study has shown that existing vertebral deformities predict an increased risk of hip fractures occurring of between 2.8 and 4.5 times, which increase with the number of deformities and their intensity. The incidence of new vertebral fractures in the year after the appearance of a vertebral fracture is 19.2%, and the accumulated incidence over 10 years of any type of fracture after an earlier fracture is 70%. All these data, taken together, show the importance of taking appropriate therapeutic measures after the diagnosis of an osteoporotic fracture.

Risk factors for fractures
There are many factors associated with the risk of developing osteoporotic fractures. Some of these, notable among which is bone mineral density as the most predictive, directly influence bone resistance, while others are related to falls and their characteristics. All these factors interact in each individual in a complex way. Although a detailed review of these factors is outside the scope of this chapter, Table 1 lists the principal factors according to SEIOMM’s clinical practice guide.

Mortality after osteoporotic fracture
The patterns of mortality after the most frequent types of fractures have been studied. In the Rochester, USA cohort the rate of survival 5 years after suffering a hip or vertebral fracture was 80% of that expected in men and women of similar age. In our country, 13% of patients who have suffered a fracture die in the following 3 months. In the two years after the fracture, mortality reaches 38%.

Mortality of hip fracture
The mortality associated with fractures of the hip is higher in men than in women and increases with age, as well as in those subjects with major co-morbidities and a worse functional state pre-
fracture. Around 8% of men and 3% of women of more than 50 years of age die while hospitalised due to fractures. In the United Kingdom, survival after suffering a fracture of the hip is 63.6% in men as against an expected 90.0%, and in women 74.9% as against the 91.1% expected. The risk of death is maximum immediately after the fracture and reduces gradually with time. The cause of death is not usually attributed to the fracture directly, but to other co-morbidities present.

**Mortality after vertebral fracture**
In contrast to what occurs with hip fractures, vertebral fractures are associated with an increased risk of death later in the year after the fracture. Again, the excess risk appears to be due to co-morbidities present, but differently from the case with hip fractures, it worsens over time. In the GPRD study the survival observed a year after suffering a vertebral fracture was 86.5% against 93.6% expected. At five years, the survival observed was 56.5% against the 69.9% expected.

**Morbidity after osteoporotic fracture**
In the USA, 7% of the survivors of any type of fracture have some kind of permanent limitation and 8% require chronic hospital care. On average, a white north American woman of 50 years has a 13% probability of suffering a functional deterioration after any kind of fracture. In our country 45% of patients who have suffered a vertebral fracture are left with functional damage and up to 50% can develop total or partial disability.

**Morbidity after hip fracture**
As in relation to mortality, hip fractures are the main cause of later morbidity. Patients with hip fracture have a propensity to develop of acute complications such as ulcers due to decubitus, broncho-pneumonia and infections of the urinary tract. Perhaps the most significant complication in the long term is difficulty in deambulation which appears in 50% of cases. Age is a key determinant of what happens after the fracture: while only 14% of subjects receiving a fracture between 50 and 55 years of age are sent to hospital for chronic care, up to 55% of those over 90 years of age need to continue to receive chronic care.

**Morbidity after vertebral fracture**
In spite of the scarce or zero symptomology of the majority of vertebral fractures, their high frequency makes them responsible for a great number of hospitalisations: almost 2,200 a year in England and Wales in patients older than 45 years of age. The principal consequences of a vertebral fracture are back pain, kyphosis and loss of height. The scores of the specific quality of life test (QUALEFFO) diminish in line with an increase in the number of vertebral fractures.

**Morbidity after distal forearm fractures**
Fractures of the distal forearm do not appear to increase mortality. While fractures of the wrist can impact adversely on daily activities such as writing or cooking, few patients are left completely incapacitated. However, up to 50% of
those subjects who suffer such a fracture state that they have a poor functional state 6 months on from the fracture\textsuperscript{a}.

**Conclusions**

Osteoporosis is a disease which has an enormous impact on public health, both from the point of view of the individual, and collectively for health systems, economies and populations. The epidemiological characterisation and better knowledge of the risk factors for osteoporotic fractures, combined with the development of drugs of proven efficacy, puts us in an excellent position for the development of preventative and therapeutic measures, both populational, as well as for those individuals at high risk.

**Bibliography**