**Cost of postmenopausal osteoporosis**

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**Introduction**

Osteoporosis (OP) is a common disease, responsible for a great number of the fractures occurring in people over 50 years of age. Through various pathogenic mechanisms a reduction in bone mass occurs, which is accompanied by an increase in bone fragility. Osteoporotic fractures in the vertebrae, the hip, the forearm and the humerus are the most frequent. They are a massive health problem due to their repercussions, not only on the health and quality of life of the patients, but also due to the economic and social costs of their treatment and aftercare.

Form a conceptual point of view, it is necessary to distinguish between OP as a clinical entity and densitometric OP. With respect to the former, this consists of a systematic bone disorder characterised by a deterioration in bone resistance which predisposes it to fracture, in the light of the fact that bone resistance is the result of an integration of bone density and bone quality. The cause may have an influence on the loss of bone mass or on other elements, such as the bone’s microarchitecture, on which the quality of the tissue depends. On the other hand, the latter is an operative definition proposed by the working group of the World Health Organisation (WHO) meeting in 1992. This took into account a number of levels or cut-off points of bone mineral density (BMD) for postmenopausal white women. Thus, considered as normal are those values of BMD above -1 standard deviation (SD) in relation to the average for young adults (T-score > than -1); osteopenia corresponds to values of BMD between -1 and -2.5 SD (T-score between -1 and 2.5); OP, values of BMD lower than -2.5 SD (T-score lower than -2.5); and established OP, when in addition to the above conditions are combined with one or more osteoporotic fractures. This definition is mainly useful as an epidemiological and diagnostic classification criterion, but should not be used in isolation, with other circumstances having to be taken into account such as age, rapidity of bone loss or the frequency of falls, since BMD only explains 70% of bone fragility.

The impact of OP results from its most significant complication, fractures. Therefore, not only should the diagnosis of a reduced BMD be considered, but also an evaluation of the risk of fracture. A series of indices have been developed with this objective, notable among which due to its popularity is that proposed by the WHO study group, called FRAX, which includes a series of clinical parameters, in addition to the BMD, for the evaluation of the risk of fracture. These parameters are independent of the BMD, included among which are previous history of fragility fractures, family history of osteoporotic fractures, thinness and active smoking, alcohol consumption and an increase in bone turnover. It is not surprising that the frequency of falls is also associated with a higher risk of fracture.

**Importance and impact of OP**

OP has a great impact on the health and the economy of developed countries. Osteoporotic fractures have a sizeable impact from a socioeconomic point of view. Although measures have been proposed to reduce the problem, OP continues to be underdiagnosed, and many patients, even with fractures recognisable as osteoporotic, remain without treatment. Social and political measures are still insufficient to address the prevention of this serious socio-health problem.
OP is a very common disease, which affects 150-200 million people in the world. Approximately half of these patients come from the developed nations of North America, Europe and Japan. In general terms, it is estimated that around 33% of women over 50 years of age have OP. Its prevalence in women increases with age from 15% in the interval between 50 and 59 years, to more than 80% at ages over 80 years. In males the prevalence of OP is lower, 8% according to the data from the NHANES study.

In Spain, nearly 2 million women and 800,000 men have OP. The prevalence of densitometric OP is 26.07% (CI: 95%, 22.57-29.57%) in women over 50 years of age, much higher than that observed in men, 8.1% in those over 50 years of age, and 11.3% in those over 70 years of age. Osteoporotic fractures are responsible for the serious clinical and socioeconomic consequences of OP. The disability produced by OP in Europe is greater than the impact of many cancers and other chronic diseases such as rheumatoid arthritis, asthma or the cardiac repercussions of hypertension.

Osteoporotic fracture, calculated using data from the year 2000 across the whole world, reached a figure of 9 million fractures, of which more than half occurred in Europe and the United States, with the following distribution: of the hip, 1.6 million; the forearm, 1.7 million; and clinical vertebral (symptomatic) 1.4 million. Current data have been projected into the future and it is estimated that these fractures will increase in the coming decades. There are no direct data regarding the number of fractures in Spain globally, but it is thought that the number may reach 100,000 fractures a year, with direct costs greater than 126 million euros, and indirect costs of 420 million euros.

The prevalence of vertebral fractures is difficult to quantify. More than two thirds are asymptomatic and can only be diagnosed by imaging methods, generally lateral X-ray of the lumbar and dorsal spine. The presence of existing fractures in women over 65 years of age multiplies by 7-10 times the risk of suffering another new fracture in the next 5 years. It also increase the probability of suffering non-vertebral fractures, with an estimated risk quotient of 2.8-4.5, and this increases with the number of vertebral deformities.

Vertebral fractures are infrequent before the age of 50 but, as with other fractures, increase with age. Various studies have indicated that their prevalence in women older than 50 is between 18 and 28% between 40 and 65 years of age, followed by a plateau which remains for the subsequent years. In Europe, data on prevalence come principally from the “European Vertebral Osteoporosis Study” (EVOS), in which has been observed a prevalence of 12.2% for men and of 12% for those between 50 and 79 years of age. The individuals in this study were later included in a prospective study: “European Prospective Osteoporosis Study” (EPOS). The annual incidence is considered to be 1% in women of 65 years of age, 2% in those of 75 and of 3% in those over 85 years of age. In men over 50 years of age it is between 5.7 and 6.8/1,000 people/year, which is equivalent to approximately half of that observed in women. More recent Spanish data coming from the “Osteoporotic vertebral fracture and associated risk factors” (FRAVOS - “Fractura vertebral osteoporótica y factores de riesgo asociados”) study in a population from Valencia, indicates that the prevalence of vertebral fractures in women over 50 years of age is 21.4%, which increases up to 46.3% in those over 75 years of age.

Non-vertebral fractures, excluding cranial and cervical fractures, are more numerous than vertebral fractures in the population with postmenopausal OP, and greatly exceed the sum of those in the hip and wrist. Their locations are highly diverse and the frequency in each location is very small, with the exception of those in the hip and wrist. As we have indicated, hip fractures are notable by their high morbimortality. They are frequent fractures, affecting 1% of the population. Hip fractures make up 10% of all non-vertebral fractures, but their percentage increases with age, reaching 40% after the age of 80 years.

Fractures of the hip are considered, from a prognostic point of view, the most serious due to their high morbimortality. Less than half of these patients will recover to their earlier state, since 25% will need home care and 20% with remain in a continuing state of dependence. The incidence increases exponentially with age, and is double in women compared with men. Most of these fractures occur after a fall from a height equal or less than the patient’s own height. The global risk of fracture of the hip from 50 years of age in the United Kingdom is 11.4% and 3.1% for women and men, respectively. The incidence varies substantially from one population to another, and is usually higher in white Caucasian individuals. In Europe, the proportion of hip fractures varies up to 7 times between different countries. Spain is considered to be a zone of moderate incidence, while in Norway, Sweden, Iceland, Denmark and the US the incidence is high. In our country the annual incidence is highly variable, varying between 301/100,000 and 897/100,000 patients over 65 years of age per year.

Distal fractures of the ulna and radius, or Colles fractures, have a different presentation profile to those previously mentioned. Data is more scarce than for vertebral or hip fractures. Most of the incidence data comes from the Northern hemisphere, principally from the Scandinavian countries, the United Kingdom and the US. There is an increase in incidence in Caucasian women between 40 and 65 years of age, followed by a plateau which remains for the subsequent years, which has been related to an alteration in neuromuscular reflexes caused by aging, and to a tendency to suffer falls whose impact the patient automatically attempts to mitigate by extending their arms. This type of fracture appears mainly in women, and mostly after the age of 65. In the United Kingdom the lifetime risk of fracture in women of 50 years of age is 16.6%, while at 70...
years of age this risk falls to 10.4%. The incidence in males is significantly lower and does not change much with age (risk during the rest of life of 2.9% at 50 years of age and 1.4% at 70)\(^2\).

**Cost of OP and osteoporotic fractures**

In addition to the personal repercussions due to its high morbimortality, OP generates highly significant socioeconomic costs and the analysis of these costs bring with them great uncertainty, given that their calculation is difficult, with a possibility bias. The information available is incomplete\(^2\), both in relation to the prevalence of fractures and in the data on related costs. The most reliable data come from the analysis of hip fractures, of which is it easy to understand the incidence and the direct hospital costs. The most common analysis of costs are the cost-effectiveness studies of drug interventions. Many of the calculations in cost studies are based on theoretical models which use known epidemiological data. The results are expressed in monetary units or on the basis of the loss of quality-adjusted life years (or QUALY)\(^2\).

The calculation is complex and needs to include the consequences of the impact on the individual (among others, the possibility of death caused by bone diseases) and the impact on the emotional state. The socioeconomic costs are divided into direct and indirect costs. Among the first are those derived from hospitalisation, ambulatory care and drug treatment. These costs may be related to acute, social and hospital care, both short and long term, and the drugs. Included in the non-medical direct costs are social and informal care. Included in the costs of social care are the costs of adaptations of the home, health care received in the home, home care and transport. Lastly, the indirect costs mainly include the loss of production of the patient or of the family members who look after them.

The hospital costs are influenced by the duration of the hospitalisation. In the ambulatory care is included the visits to the orthopaedic surgeon, visits to other doctors, including the general practitioner, visits by the nurse, the physiotherapist, the occupational therapist and the cost of help over the phone.

One of the problems resulting from fractures is disability. Some models of socioeconomic study use an approach in which the costs are calculated as disability-adjusted life years (or DALY)\(^1\). In addition to the significant economic costs, fractures have a social impact which, although influencing the costs, should be considered independently, in the same way as mortality or morbidity are. Many of the economic studies come from Sweden or the United Kingdom. The annual loss related to fractures in Sweden is 15,930 QUALYS\(^2\). In stratifying them by risk, which is to say, by age, the value of the loss on one QUALY in the United Kingdom, with reference to 2002, is £103,572 at 50 years, £149,226 at 60 years, £186,818 at 70 years and £488,050 at 80 years\(^3\).

In addition, in fractures, the reduction in the quality of life related with health has a significant individual social cost. In a recent study carried out in the “Canadian Database of Osteoporosis and Osteopenia (CANDOO) cohort, the quality of life is notably reduced in spite of treatment when the Mini-Osteoporosis Quality of Life Questionnaire is used\(^9\).

**Cost of hip fracture**

The cost of hip fractures vary according to the country in which they are considered. The report of the International Osteoporosis Foundation (IOF) from 2008, observed variability in days of hospital stay due to hip fracture between different European countries, which is undoubtedly reflected in the cost\(^1\). It is probable that these costs will increase in the coming years. According to Spanish data, the frequency of hip fracture appears to increase independently of age\(^2\), a fact which is observed in other countries in our area and, according to the IOF report, it is expected to increase significantly in the next few decades, doubling by 2050.

Among the circumstance which contribute to expenditure due to hip fractures are, in addition to direct costs, mortality, disability and the need for institutionalisation. The cause of death on many occasions is not directly related to the fracture. It has a biphased pattern of frequency, with an initial peak in the first 4 weeks and another increase later, at between 6 and 12 months. There is a later decrease in frequency, although it remains above expected levels in subsequent years\(^1\). Mortality is 20-30% in the first year, which means that the risk of death increases by 2 to 10 times of the levels expected in a population with similar characteristics\(^7\). The excess in mortality is estimated as a risk of 3.35 (CI 95%, 1.5-7.47) compared with the later risk of 1.30 (CI 95%, 0.85-1.98)\(^8\).

Another of the social costs is dependency, which is seen in more than half of the patients who survive after a hip fracture. In the combination of disabilities attributable to osteoporotic fractures, the hip fracture has the greatest costs. 40% of the DALYs lost because of OP are due to fracture of the hip\(^2\). Due to their situation of dependency many patients have to be institutionalised in order to be cared for, generally in an old people’s home. This represents a significant expenditure which is not always taken into account. The clearest information comes from the analysis of costs in the United Kingdom. The percentage of patients institutionalised varies with age, from 4% at 60-79 years, to 12% at 80-89 years and up to 17% above 90 years\(^9\).

The global cost of hip fractures was calculated at $4,800 million dollars in 1990, and this figure will continue to rise, it being calculated to reach 131,500 million dollars in 2050\(^7\). In the US the cost of hip fractures is estimated to be 19,300 dollars during the first year in women over 65 years of age, and 21,700 dollars for the age range 50 to 65 years. The greatest cost is represented by hospital
stays, which amount to 50% of the total cost. The direct costs vary between European countries. In Sweden it varies between 9,396 euros in patients from 50 to 64 years of age and 25,253 euros in those over 85 years of age. In Belgium it is calculated at 16,624 euros, while in Spain the cost is estimated to be lower than in Sweden, at 6,759 euros.

Other costs to be considered are those derived from the care of patients once they have passed the acute period of the fracture. In the United Kingdom they take into account for their calculation various parameters related to the possible outcomes of hip fracture: the most favourable is discharge and return home; the second, less favourable is that the patient becomes incapacitated and is moved to an old people’s home or a hospital for the chronically ill; finally, the worst outcome is death in the first year after fracture. These global annual social costs, relating to the year 2002, are estimated at more than 30 million pounds sterling. In this would be included patients who go back to their homes (45%), at £1,750 per patient; those who die in the first year (30%), at £2,964 per person; and those patients who require long term institutionalised care (25%) whose costs rise to £22,218. The total costs due to medical visits to the primary care doctor in the first year is estimated to be 8.5 million pounds.

In the following years the costs varied between those who live at home and those who are institutionalised. Taking this into account, the total costs are £6,635 for patients at home, £27,228 for those who are institutionalised, and finally, for those who die, £7,772. However, many studies do not normally estimate the costs of later years, which would be 0 for those who die. It is assumed that those who return to their homes (non-complicated fracture) would also have a low cost. However, when they are admitted to private residences there is an additional cost of £18,900 per patient.

The cost at 2002 prices of fracture in a patient who returns home is different according to age. The cost would be £4,880 at 50 years of age, and increases to £8,800 for those over 80 years of age. Similarly, younger patients who enter a residence have a cost of £29,620, while this would increase to £32,795 in the group of patients of 80 years of age.

In those who return home is different according to age. In subsequent years, the cost of those over 80 years of age has a cost of £29,620, while this would increase to £32,795 in the group of patients of 80 years of age.

In the group between 50 and 64 years of age and 166,232 Swedish crowns in the group over 85 years of age, at 2005 prices. The costs which occur in the period between 12 and 18 months after the fracture of the hip reach 14,360 euros. The cost also varies greatly between age groups, from 527 euros in the 50-64 age group to 4,000 euros in those over 85 years of age. At all ages the cost is higher in men than in women.

There are, logically, differences depending on the outcome. Between those who die in the first 4 months and those who die at between 5 and 18 months, and those who survive beyond this time. In those who die in the first few months the cost is 14,115 euros, while in those who survive more than 18 months the cost is 11,350 euros.

Bibliography


