Epidemiology of Hip Fracture and Social Costs

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2.1 Introduction

Hip fractures constitute a remarkable public health problem in industrialised countries, since this condition is associated with a higher rate of disability and mortality [1]. Therefore, it is hardly surprising that hip fracture is also associated with enormous social and economic costs. Moreover, since hip fracture incidence linearly increases with advancing age, and it is estimated that older people will represent a substantial proportion of the worldwide population in future, the costs of hip fracture will probably increase.

In this chapter, we aim to summarise the current epidemiological data about this condition, with a special focus on the economic impact.

2.2 Epidemiological Data

2.2.1 Risk Factors for Hip Fracture

The pathogenesis of hip fracture is multifactorial. Although many conditions contribute to the development of hip fracture, the main factors can be summarised in two wide categories: those affecting/decreasing bone mineral density (BMD) and those increasing the rate of falls.

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2.2.2 Factors Affecting Bone Mineral Density

The factors negatively affecting BMD are the same as those that increase the risk of osteoporosis. Since another chapter is specifically dedicated to this important issue, we will say only a few words about it.

The conditions negatively affecting BMD could be further categorised as: non-modifiable and modifiable factors [2, 3].

In the first category, we should mention age, female sex, race, family history of osteoporosis and fractures, and low body frame size. In this category, we could insert the long list of the genetic factors and mutations leading to an increased risk of osteoporosis and so of fragility fractures.

Conversely, among the modifiable factors we can consider low calcium intake, reduced exposure to sunlight, inflammatory diseases (particularly if affecting the gastrointestinal system), some drugs (e.g. cortisone), excessive alcohol intake, eating disorders (particularly anorexia nervosa) and body mass index (BMI), which seems to be associated with hip fractures in a U-shaped way [4–6].

2.2.3 Factors Increasing Rate of Falls

Although in the literature it is mentioned that hip fracture can occur without any trauma, this is not the general rule. Older people, in fact, usually have a hip fracture after a trauma, although often it is a minor trauma, such as a fall from standing height. We could say that the interaction between trauma and low BMD typically lead to the hip fracture. This is somewhat different from other osteoporotic fractures, particularly vertebral ones, which do occur without explicit trauma, probably because of the different composition of bone components.

Therefore, knowledge of factors that increase the rate of falls seems to be important for tailoring appropriate preventive interventions. The risk factors for falls can be categorised as intrinsic (i.e. pertaining to the subject) or extrinsic (i.e. pertaining to the settings in which the person lives).

Among the first, we could count:

- Advanced age;
- Poor physical performance (including gait and balance problems): it is known that poor physical performance and particularly muscle weakness increased the risk of falls [7];
- Poor vision and hearing; [8]
- Orthostatic hypotension; [9]
- Chronic conditions including osteoarthritis, diabetes, neurological conditions etc.: these conditions are usually associated with a higher risk of falls through anatomical changes in the joints (like osteoarthritis), less sensitivity (diabetes) or higher use of psychoactive medications that could increase the risk of falls (like dementia or Parkinson's disease).
- Fear of falling;

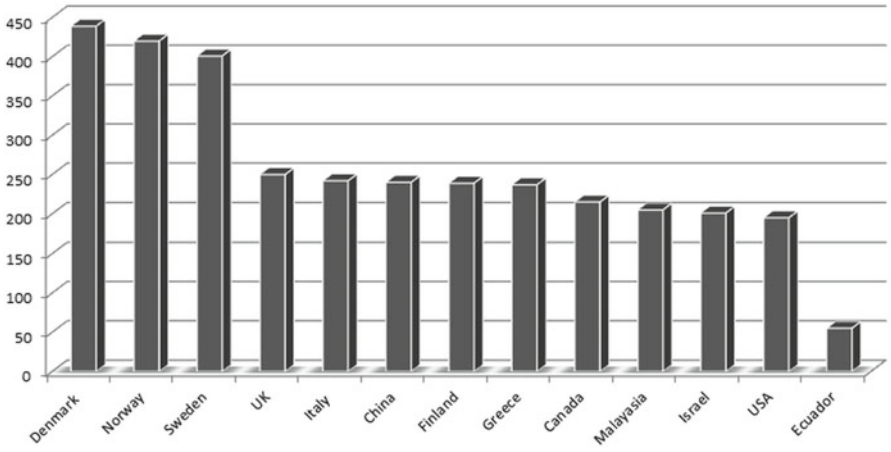

Fig. 2.1 Age-standardised hip fracture incidence rates (/100,000) for some representative countries

The extrinsic factors include those affecting the setting in which the older person lives. These are of particular importance because they are easily modifiable [10]. Some examples are:

- Lack of stair handrails;
- Poor stair design;
- Lack of bathroom grab bars;
- Dim lighting or glare;
- Obstacles and tripping hazards;
- Slippery or uneven surfaces;
- Improper use of assistive device.

2.3 Prevalence and Incidence of Hip Fracture

Prevalence and incidence rates of hip fracture reported in different studies vary significantly around the world and it is suggested that the two major causes of these differences are gender and race. The International Osteoporosis Foundation (IOF) estimates that worldwide hip fractures will occur in 18 % of women and 6 % in men [11].

Figure 2.1 shows the age-standardised incidence rates for hip fracture (/100,000) for some representative countries. Considering both genders together, the highest incidence was observed in Denmark (439/100,000), the lowest in Ecuador (55/100,000) [12].

Regarding the site usually affected by hip fracture, in the United States, femoral neck and intertrochanteric fractures are very similar in frequency in patients aged more than 65 years, with a higher frequency in white women than in men [13].

2.3.1 Gender Differences

Because women have more bone loss and higher rate of falls than men, the incidence of hip fracture in this sex is about twice that seen in men at any age in the industrialised countries [3].

It is estimated that about one third of women living to age 80 will have a hip fracture [14]. This risk is somewhat comparable to the combined risk of developing any kind of genito-urinary cancer [15]. In women, the lowest annual incidence rate was seen in Nigeria (2/100,000), the highest in Northern Europe countries, like Denmark (574/100,000), Norway (563/100,000) and Sweden (539/100,000) [12].

Regarding men, it is estimated that each year they experience about one third of the total hip fractures affecting a population. However, in this gender, the risk for hip fractures exponentially increases after age 70, and 17 % of men living beyond 80 years of age will report a hip fracture [16]. Although less frequent than in women, hip fractures in men seem to be more dangerous, since one third of men reporting a hip fracture die within 1 year [16].

In this gender, the lowest incidence rate was seen in Ecuador (35/100,000) and the highest in Denmark (290/100,000) [12].

2.3.2 Racial Differences

Whites (particularly if living at higher latitudes) exhibit a higher age and sex-adjusted incidence of hip fractures ranging from 420/100,000 new hip fractures each year in Norway [17] to 195/100,000 in USA [18]. After age 50, white women have an almost doubled risk of hip fracture than men with the highest annual incidence of hip fractures after 80 [1, 12].

Interestingly, people living in the Mediterranean area, although mainly whites, report lower incidence of fractures. This seems to be attributable to several factors, particularly higher serum 25-hydroxy vitamin D (25OHD) levels and healthier lifestyle [19]. Recent research highlights a role also for the Mediterranean diet since it is known that this dietary pattern is associated with lower inflammation levels, lower adiposity and decrease risk of falls, all these factors being important for the development of hip fracture [19, 20].

By contrast, fewer studies have investigated the epidemiology of hip fractures in other races.

Blacks seem to have a decreased risk of hip fracture compared to whites, reporting an age and sex adjusted incidence ranging from 31/100,000 in the Bantu population [21] to 185/100,000 in California [22].

Asians demonstrate a risk of hip fracture intermediate between whites and blacks [23, 24]. Around 30 % of the hip fractures occurring worldwide are thought to arise in Asian populations, most notably in China, making this country of particular

importance [25]. The incidence observed among men and women between 1966 and 1985 significantly increased (1.7 fold among men and 2.5 fold among women), however between 1985 and 1995 it remained steady [25]. Regarding other Asiatic countries, the most recent studies from Hong Kong and Singapore suggest that temporal trends may have reached a plateau, but those from Japan suggest significant age-adjusted increases [26, 27].

Finally, Hispanic populations show the lowest incidence of hip fractures among all the races investigated and interestingly the ratio between women and men is reversed [1, 12]. However, annual fracture rates among the Hispanic population increased significantly (4.2 % in men and 4.9 % in women) between 1983 and 2000, in contrast to other races [28].

2.3.3 Time Trends in the Incidence of Hip Fractures

The total number of persons affected by hip fractures may be increasing over time in the next years, mainly due to the progressive ageing of the population. Indeed, the absolute number of hip fractures is expected to increase to 4.5 million by the year 2050 [25]. However, these projections do not take into account several important confounders, such as the increased use of anti-osteoporotic drugs, the use of supplementation with calcium and vitamin D and the strategies adopted by some countries for the early identification of osteoporosis.

Right now, reported trends differ markedly across countries with some studies reporting a significant increase [29–32], some a decrease [33–37], and some others stable rates [38–40]. In studies reporting a lower incidence of age- and sex-specific incidence hip fracture over time, possible explanations seem to be a higher adherence to anti-osteoporotic medications as well as increased use of calcium and vitamin D supplementation, avoidance of smoking and alcohol, and more efficacious strategies for the prevention of falls [41].

In summary, with a few exceptions, age-specific incidence rates of hip fractures significantly rose in Western populations until 1980 with subsequent stability or sometimes a decrease. In Western countries, the trends seem to be more pronounced in women than in men [25]. However, a final word cannot be given regarding this relevant issue and future longitudinal studies (particularly in populations not including whites) are needed, to see in which direction we are moving.

2.4 Social Costs

In contrast to other types of fragility fracture (e.g. vertebral), hip fractures usually need immediate intervention and consequently hospitalisation. Every year about 300,000 subjects are hospitalised with hip fractures in the United States alone [42]. Approximately one-third of fracture patients receive prosthetic replacement. It is

therefore hardly surprisingly that in the United States alone, the estimated cost of treatment was approximately 10.3 to 15.2 billion dollars per year in 1990 [43] and 17 billion in 2002 [3].

Hip fractures require a long period of hospitalisation, usually longer than other medical conditions, except for psychiatric diseases [44].

The burden of hip fracture management on both the individual and society is substantial, and includes direct fracture-treatment costs and social costs resulting from functional impairment and increased morbidity [45].

2.4.1 Hospitalisation and Rehabilitation Costs

The data available suggest that hip fracture is a condition associated with a high social cost, particularly for expenses needed for hospitalisation and rehabilitation. Expenditures are rising very quickly and are a source of concern in many countries [3]. In a prospective study lasting 1 year in Belgium, a group of 159 older women totalled a mean cost of the initial hospitalisation of $9,534 and the total direct costs during the year after discharge were $13,470. These costs were almost triple that of a group of age- and sex-matched older subjects without hip fracture [46].

It is estimated that the expenditure needed for hip fracture exceeds that for breast and gynaecological cancers combined, but not those for cardiovascular disease in USA [47]. The comparison of costs between hip fracture and cardiovascular diseases is intriguing. In Switzerland, for example, osteoporotic hip fractures account for more hospital bed days than myocardial infarction and stroke and consequently lead to higher costs [48], while in Italy the costs due to hip fractures are comparable to those of acute myocardial infarction [44].

2.4.2 Hospital Costs

Hospital costs include costs associated with surgery (implant and theatre costs), laboratory and radiological investigations and length of hospitalisation in an acute ward [49].

The mean duration of hospitalisation is highly variable. In the United Kingdom, a study reported that, in people with a mean age over 80 years, the duration of hospitalisation was 23 days, without including the days due to rehabilitation [49]. In Italy, another study in people over 45 years of age found the mean duration of hospitalisation was about 15 days, again not considering rehabilitation [44]. In the United States, on the contrary, during the period from 1990 to 2003, the mean length of stay in the hospital for hip fractures declined by about half, leading to an average hospital stay of 6.5 days [50]. It should be noted that these huge differences probably depend on the different health systems and the relative costs for each day of hospitalisation. In the United States, for example, every day in hospital costs $1,791 in for-profit hospitals, $1,878 in state/local government hospitals and $2,289 in non-profit hospitals [50],

while in the United Kingdom 1 day costs $600 [51]. It should be noted that shorter lengths of stay have been associated with higher 30-day mortality in patients experiencing a hip fracture in Sweden [52]. By contrast, a recent study in USA demonstrated that decreased length of stay was associated with reduced rates of early mortality [53]. This difference might be related to the fact that increased time to surgery is associated with longer hospital stay and we know that time to surgery (more than 24/48 h after the fracture) is a key factor in predicting early mortality [54].

2.4.3 Rehabilitation and Nursing Home Costs

Rehabilitation is a mandatory step for people having experienced a hip fracture [55]. However, the advanced age and the co-morbidities affecting hip fracture patients often dictate that the completion of the rehabilitation programme takes place in a long-term care (LTC) facility or in a nursing home [56]. The percentage of people requiring a LTC facility or similar institution is estimated at between 6 and 60 % of people with a hip fracture, with a cost ranging from $19,000 to $66,000 [56]. The costs needed for a LTC seem to be almost double those required by a rehabilitation institute [57].

However, the roles of these organisations for rehabilitation of older patients are still debated. In a well-known study on this topic, hip fracture patients admitted to rehabilitation hospitals did not differ from patients admitted to nursing homes in their return to the community or in disability rate [58]. Moreover, costs were significantly greater for rehabilitation hospital patients than for nursing home patients and the evidence about the value of these organisations in the elderly is conflicting [58–60].

2.4.4 Other Social Costs Related to Hip Fracture

Hip fracture is associated with several negative outcomes. For example, reports of permanent disability in those surviving initial hospitalisation after a hip fracture ranged from 32 to 80 % [56].

The most common and important consequence of hip fracture is, however, increased mortality. It is estimated that about 20 % of the subjects die within the first 3–6 months of their injury [61]. Moreover, as for cardiovascular diseases, the likelihood of having any subsequent hospital episodes increased by 231 %, any subsequent incident increased future incident episodes by 9.4 %, the total number of hospital days by 21.3 % and the total charges by 16.3 % [62].

Other consequences may be loss of muscle strength, increased postural sway and decline in walking speed that can lead to loss of functional muscle mass, sarcopenia and finally to disability [61]. The impact on disability is striking: 1 year after fracturing a hip, 40 % of patients are still unable to walk independently, 60 % have difficulty with at least one essential activity of daily living, and 80 % are restricted in instrumental activities of daily living, such as driving and grocery shopping [63].

Finally, hip fracture seems to be associated with the onset of other co-morbidities with a high cost for society. Recent research has highlighted that people experiencing a hip fracture have a greater incidence of depression [64] and consequently a higher use of anti-depressant medications [65]. Another field of interest is the possible relationship between hip fracture and the onset of cardiovascular diseases. Hip fracture, in fact, seems to increase the risk of coronary heart disease, particularly during the first year after the event [66]. Since cardiovascular diseases are among the most expensive medical conditions [67], the impact of hip fracture in contributing to a huge increase in medical and social costs is highly relevant.

Conclusions

Hip fracture is a common and debilitating condition, particularly for older persons. Although the age (and gender) specific incidence is decreasing in some countries, the global incidence of hip fracture is rising everywhere, suggesting that more should be done for its prevention, also in view of its impact on social costs and quality of life. Future epidemiological studies are thus needed to better verify the trend in incidence of hip fracture and the strategies effective for its prevention.

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