MORTALITY AND FUNCTIONAL IMPAIRMENT AFTER HIP FRACTURE – A PROSPECTIVE STUDY IN A PORTUGUESE POPULATION

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Abstract

Objectives: Osteoporotic hip fractures (HF) are a major cause of morbidity and mortality with increasing familial, social and economic repercussions. The objectives of this paper were to evaluate the *status vitae* at 6 and 12 months of a cohort of patients with an osteoporotic HF and the risk factors for 12-month mortality as well as to evaluate the functional outcome and the overall health perception of these patients.

Patients and Methods: We conducted a 12-month follow-up evaluation of a cohort of 184 patients older than 65 years admitted to our centre with a non-pathological osteoporotic HF from January 1st to December 31st 2007. Baseline data collection was performed in the first 72 hours after admission and, 12 months later, a second evaluation was conducted, by telephone in order to ascertain their *status vitae* and functional status. The magnitude of sex-specific, age-adjusted associations between potential prognostic factors and mortality was estimated using hazard ratios (HR) and respective 95% confidence intervals (95%CI), calculated using Cox's proportional hazards model.

Results: It was possible to ascertain the *status vitae* in 164 (89.1%) patients. Overall 12-months mortality was 26.8% (48.3% in males and 22.2% in females). Mortality was higher in patients that became bedridden, were unable to walk again, were admitted to a hospital during the follow-up for any cause and who became dependent in their daily living activities. After discharge, physical therapy and ability to walk again were associated with a lower risk of death. Most of the patients reported a decline of their overall health-related quality of life. More than 75% of patients became totally dependent after HF.

Conclusion: This study reinforces the HF poor outcome. Twelve-month mortality rates were similar to the estimates obtained in other studies, although the 6-month's mortality was higher. Physical deterioration and loss of independence in activities of daily living were evident in this study and constituted major factors for low self-esteem and deterioration of quality of life. Our findings may constitute an evidence for action in this particular population, with an active search for means to improve the outcome of HF in these patients.

Keywords: Hip Fractures; Osteoporosis; Mortality; Risk Factors; Functional Impairment; Quality of Life.

Introduction

Hip fractures (HF) are one of the most visible and debilitating consequences of Osteoporosis. They are associated with a high mortality rate and loss of independency,[1,2] and their social impact becomes even more relevant since, according to several estimates, the incidence of HF has been rising in the last decades, as a consequence of the increase in life expectancy.[3,4] Currently, HF represent one of the most important causes of morbidity and mortality in the elderly.[5,6]

The overall prognosis of HF is gloomy. Mortality rates at 12-months are very diverse ranging from 16 to 35%[7,8] and, in patients surviving a HF, morbidity is frequently serious and limiting. The functional impairment after a HF is demonstrated by the loss of capability of being independent; which has a major familial, institutional and social impact.[9] The ability to perform activities of daily living is an indicator of functional status and constitutes a measurable item for follow-up of these patients. The treatment of HF aims to prevent progression to disability and to restore preexisting functionality,[10]

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but still, it is well established that the risk of subsequent fractures (re-fractures) is increased in patients with previous low impact osteoporotic fractures[11,12] which makes it important to be aware of this risk in the post-surgery and rehabilitation periods.

The determinants of prognosis after HF, including one-year mortality, have been focused in a number of studies. However, geographical differences in the incidence of HF suggest that social and cultural factors may be responsible for an important degree of variability in the prognosis of HF across different settings.

In Portugal, epidemiological data on HF incidence and mortality have been published, but studies are mainly based on retrospective data collections or on routinely collected data from the National Health Service. Concerning incidence, studies in the Portuguese population report annual estimates ranging from 77.3 to 231.5 per 100 000 population in males and 154.4 to 572.2 per 100 000 in females.[13] Regarding mortality in the Portuguese population, published data report overall 1-year mortality rates from 14.6% to 21.7%.[14,15]

In order to obtain prospective information on HF in Portugal we conducted a study in a defined geographical region, designed to estimate the frequency and prognosis of HF. In this study we estimated an overall incidence of 154 per 100 000 population in males and 481 per 100 000 person-year in females.[16]

Using the 12-month follow-up evaluation of the same sample, the aim of the present study was to evaluate the *status vitae* at 6 and 12 months of a cohort of patients that were admitted to the hospital with an osteoporotic HF and risk factors for 1-year mortality, as well as to evaluate the functional outcome and perception of health of these patients.

Material and Methods

We conducted a 12-month follow-up evaluation of patients who were admitted to Centro Hospitalar do Alto Minho with a HF from January 1st to December 31st 2007, collecting data in 2 different times: on admittance and after 12 month. At recruitment, we considered as eligible all individuals aged over 65 years whose diagnosis at admission was HF resulting from low impact trauma, which was defined as a fracture that occurred spontaneously or as a result of a fall from a height inferior to the patient's stature.[17] Exclusion criteria were high impact trauma and metastatic or metabolic disease suspicion or confirmation. We identified 184 patients with a HF, but nine have been excluded because of a secondary cause for the fracture (six had a high impact trauma and three had a high suspicion of metastatic induced fracture). In total, 175 (82.4% females) fulfilled the eligibility criteria and were invited to participate in the baseline evaluation. This assessment included a structured questionnaire, comprising demographic, behavioral and social characteristics, fracture mechanism and medical history. Data collection occurred in all of these patients within 3 days from hospital admission and was conducted by applying the questionnaire either to the patient or, in case of impaired cognitive function, to his/her close relatives or caregivers. Only close relatives or caregivers with good knowledge of the patient's medical history were eligible to answer the questionnaire. During the recruitment, there were two refusals to participate in the study. Additional clinical data were obtained from the patients' hospital files, in order to specify type of treatment, duration of admission and discharge date.

In the follow-up evaluation, conducted 12 months after the index fracture, telephone contacts were tried with all patients who were evaluated at baseline in order to ascertain the *status vitae* and to apply a structured questionnaire. It was possible to establish contact and ascertain their *status vitae* in 164 (89.1%) patients, 29 males (17.7%) and 135 females (82.3%). There were no significant differences in age and sex distribution between patients whose *status vitae* were ascertained and those who were lost to follow-up.

As information was obtained by telephone interview, the cognitive status of the patient was determined by the inquirer in order to ensure if the patient could properly answer the questions. In 16.5% of cases it was the patient himself and without assistance that answered the questionnaire. When the information could not be directly obtained from the patient, including when the patient had died, the interview was completed with the assistance of a family member or caregiver. When a patient could not be contacted after several attempts, a registered letter was sent to its last known address, and other family members were contacted to determine the patient's status. In these cases, also the hospital electronic database was checked to determine if the patient was accounted

as admitted for any reason or if he/she was deceased. Only after all these unsuccessful attempts patients were considered lost to follow up. The telephone interview included questions regarding current health status of the patient, discharge details, treatment after discharge and also health-related quality of life, briefly assessed using the first two questions of the Medical Outcomes Study Short Form-36, and independence in activities of daily living, using the Katz's Index of Independence in Activities of Daily Living. With regard to activities of daily living, we have classified the response options for each question in 4 categories: able to do without difficulty (Cat1), able to do with some difficulty (Cat2), able to do with much difficulty (Cat3), and unable to do without assistance (Cat4). In the case of deceased patients, answers were given by relatives and caregivers and correspond to the last known condition prior to death. The proportion of response to the questions of daily living was 86.2% in males and 99.2% in female patients.

The follow-up period was calculated for each individual from the date of admission with the index fracture to the date of telephone interview or the date of death, in deceased patients. Survival throughout the first year after hip fracture was analyzed using the Kaplan-Meier method and the significance of gender differences was evaluated using the log-rank test. The magnitude of sex-specific, age-adjusted associations between potential prognostic factors and mortality were estimated using hazard ratios (HR) and respective 95% confidence intervals (95%CI), calculated using Cox's proportional hazards model.

Results

Patients' demographic characteristics are shown in Table I. Most of the HF were trochanteric in both genders and occurred as a result of a fall at the patients' home in the majority of cases (Table II). Mortality at 6 months was 31.0% (9 patients) in males and 14.1% (19 patients) in females. The overall 12-month mortality rate was 26.8% (44 patients), with 48.3% for males and 22.2% for females (Figure 1). Throughout the follow-up period, mortality remained significantly higher in men (Figure 2) and in patients with femoral neck fractures, when compared to those with per-trochanteric fractures (Figure 3). Deaths occurred at hospital facilities in 69.2% of men and 34.5% of women.

Table I. Patient Demographic Characteristics (N=164)

Parameters	Number	Percentage
Age (years)		
65-74	24	14.6
75-79	38	23.2
80-84	43	26.2
≥85	59	36.0
Gender		
Female	135	82.3
Male	29	17.7
Formal education (years)		
None	60	36.6
1-3	52	31.7
≥4	42	25.6
Missing	10	6.1

Table II. Characteristics of Hip Fracture Episodes (N=164)

Parameters	Males n (%) 29 (17.7)	Females n (%) 135 (82.3)
Hip fracture location		
Pertrochanteric	19 (65.5)	78 (57.8)
Femoral Neck	10 (34.5)	56 (41.5)
Unspecified	0 (0.0)	1 (0.7)
Mechanism of fracture		
Fall	28 (96.6)	126 (93.3)
Other	1 (3.4)	9 (6.7)
Site of occurrence		
Home	17 (58.6)	83 (61.5)
Nursing home	5 (17.2)	22 (16.3)
Outdoors	7 (24.1)	30 (22.2)
Duration of admission (days)		
< 7	10 (35.7)	39 (29.8)
7-13	11 (39.3)	65 (49.6)
≥14	7 (25.0)	27 (20.6)
Surgical intervention		
Yes	24 (82.8)	134 (99.3)
No	5 (17.2)	1 (0.7)

From the answers obtained we found that after discharge 51.7% of men and 68.9% of women were bedridden and there was a large proportion of patients who were not able to walk again on their own (44% of males and 32.8% of females). Also a large number of patients were admitted by any cause to

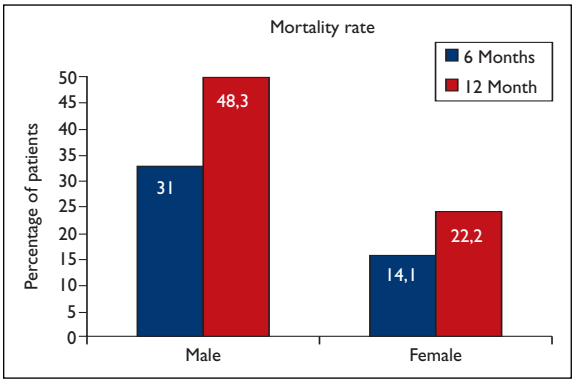

Figure 1. Mortality rates by gender.

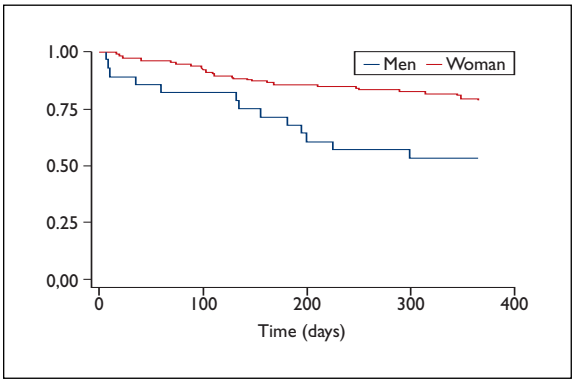

Figure 2. Kaplan-Meier analysis of cumulative survival after hip fracture, according to sex.

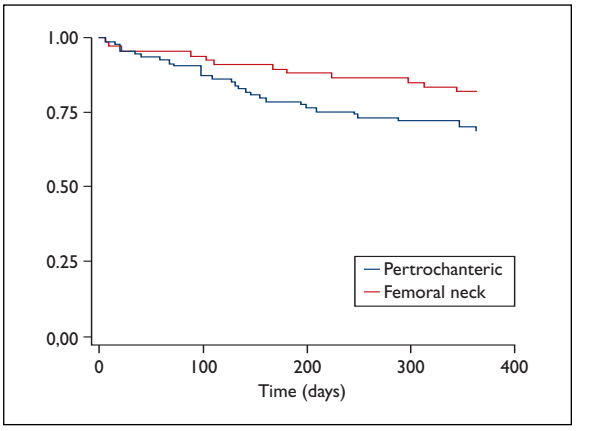

Figure 3. Kaplan-Meier analysis of cumulative survival after hip fracture, according to anatomical site of fracture.

Table III. Risk factors for mortality (n=164)

Parameters	Males (%)	Females (%)
Becoming bedridden after HF	51.7	68.9
Being able to walk again	56.0	67.2
Hospital admission in last year	43.5	32.1
New fall during last year	8.3	22.4
Treatment for Osteoporosis in last year	76.2	81.8
Treatment with low molecular weight heparin	27.6	36.3
Physical Therapy after discharge	44.8	36.6
Total dependency after HF	76.0	77.6

a hospital during the first year after HF, greater in males (43.5%) than females (32.1%). The proportion of patients that became dependent after HF was very high, i.e., above 75% in both genders. Prescription of anti-osteoporotic treatment was frequent in both genders. Patient outcomes and treatment after discharge are shown in Table III.

We found that 12-month mortality increased with age in women (HR per year =1.11, 95%CI: 1.05--1.17). After age-adjustment, mortality among men was higher in patients who became bedridden after fracture (HR=8.15, 95%CI: 1.02-65.16) and in those who reported another hospital admission for any reason during follow-up (HR=10.36, 95%CI: 1.45-74.20). Mortality was lower among men who reported having regained the ability to walk (HR=0.12, 95%CI: 0.02-0.57) and in those who underwent physical therapy during follow-up (HR=0.24, 95%CI: 0.06-0.90). In women, we observed a direct dose-response relationship between length of the index hospital admission and mortality. As in men, women who reported a hospital admission during follow-up were more likely to die (HR=2.40, 95%CI: 1.12-5.18), as were those who became bedridden after fracture (HR=2.10, 95%CI: 0.72-6.17), although the latter non-significantly. Ability to walk during the follow-up period was also associated with a good prognosis (HR=0.25, 95%CI: 0.10-0.60) (Table IV).

Regarding health-related quality of life, 74.5% of women reported fair or poor general health status, 42.4% answered that their health status was worse or much worse when compared with the previous year, and 11.9% reported being much or somewhat better (Table V). The percentage of answers to the daily living activities questionnaire was 86.2% in males and 99.2% in females. As previously described, in this questionnaire, answers could be given by close relatives or caregivers and,

Table IV. Age-adjusted hazard ratios (HR) and 95% confidence intervals (95%CI) for the association between prognostic variables and mortality over the first year

Parameters	Males HR (95% CI)	Females HR (95% CI)
Age (per year)	1.05 (0.97-1.13)	1.11 (1.05-1.17)
Hip fracture location (femoral neck vs. pertrochanteric)	1.01 (0.33-3.14)	0.49 (0.20-1.16)
Length of index hospital admission (vs. <7 days)		
7-13 days	0.41 (0.10-1.74)	1.08 (0.40-2.89)
≥14 days	1.24 (0.35-4.32)	2.62 (0.99-6.91)
Becoming bedridden after HF (yes vs. no)	8.15 (1.02-65.16)#	2.10 (0.72-6.17)
Being able to walk again (yes vs. no)	0.12 (0.02-0.57)#	0.25 (0.10-0.60)#
Hospital admission in previous year (yes vs. no)	10.36 (1.45-74.20)#	2.40 (1.12-5.18)#
Treatment with low molecular weight heparin (yes vs. no)	2.08 (0.51-8.48)	0.93 (0.37-2.35)
Physical therapy after discharge (yes vs. no)	0.24 (0.06-0.90)#	0.62 (0.28-1.37)
Total dependency after hip fracture	–	10.68 (1.39-82.17)#

– p value<0.05

Table V. Health Quality Perception (n=34)

	Males n (%)	Females n (%)
Compared to one year ago, how would you rate your health in general now?		
Much/somewhat better now than a year ago	1 (16,7)	7 (11,9)
About the same as one year ago	2 (33,3)	27 (45,8)
Somewhat worse now than one year ago	1 (16,7)	19 (32,2)
Much worse now than one year ago	2 (33,3)	6 (10,2)
In general, would you say your health is:		
Excellent/Very good	0 (0.0)	1 (1,7)
Good	2 (33,3)	14 (23,7)
Fair	4 (66.7)	30 (50.8)
Poor	0 (0.0)	14 (23.7)

in case of death, the answers reported to the last known condition prior to death. Results of this query are shown in Table VI.

Overall, these results reflect the poor outcome of HF in terms of mortality and functional impairment.

Discussion

This study was designed in a prospective manner, with transversal evaluations in two moments in time: the baseline interview at admission and a telephone interview 12 months later. To our knowledge this is the first prospective study about HF mortality and functional outcome performed in Portugal. The fact that all of the patients were observed at the starting point had some advantages over similar studies done, including in the Portuguese population. The greatest benefits were the much less missing information when compared to retrospective studies and the involvement of the patient in a project that could give a new insight on the reality of HF in our country, with its own population. This social consciousness, in our perspective, increased the acceptance of the telephone interviews, which was complete (100%).

Regarding incidence, previously reported Portuguese data in studies from the 90s estimated annual incidences of HF ranging from 128 and

Table VI. Katz Index of Independence in Activities of Daily Living (n=159)

Items	Cat. 1 %	Cat. 2 %	Cat. 3 %	Cat. 4 %	
1. Ability to eat and drink	44.0	8.0	16.0	32.0	
2. Sitting down and getting up from a chair	16.0	20.0	4.0	60.0	
3. Lie down and getting up from a bed	16.0	16.0	8.0	60.0	
4. Dress and undress	8.0	24.0	4.0	64.0	
5. Go to another house division in the same floor	20.	12.0	8.0	60.0	♂
6. Going up or down stairs	8.0	16.0	12.0	64.0	(n=25)
7. Getting in and out of the house	12.0	20.0	4.0	60.0	
8. Walk outside the house	8.0	20.0	12.0	60.0	
9. Wash the face and hands	32.0	16.0	8.0	44.0	
10. Taking a bath	8.0	8.0	8.0	76.0	
1. Ability to eat and drink	52.9	9.7	8.9	28.3	
2. Sitting down and getting up from a chair	13.4	19.4	17.9	49.2	
3. Lie down and getting up from a bed	11.2	20.9	17.9	50.0	
4. Dress and undress	9.0	18.6	12.7	59.7	
5. Go to another house division in the same floor	15.8	19.5	23.3	41.3	♀
6. Going up or down stairs	3.7	14.2	17.9	64.2	(n=134)
7. Getting in and out of the house	9.0	19.4	12.7	58.9	
8. Walk outside the house	6.7	20.1	14.2	59.0	
9. Wash the face and hands	40.3	18.7	7.4	77.6	
10. Taking a bath	5.2	13.5	3.7	77.6	

297/100 000 person-year in females and 81 and 136/100 000 in males.[6,18] One study from the period between 2000 and 2002 revealed higher incidences. The authors of that retrospective study, based on data provided by the National Institute of Informatics and Financial Management, estimated an annual incidence of 257 and 447/100 000 HF in males and females, respectively.[19] Another recent 3 year retrospective study found an overall annual incidence of 270/100 000.[20] The estimated incidence in this study was 254/100 000 in males and 481/100 000 in females, which is superior to previously reported data in Portugal, but similar to data from Mediterranean countries.[21,22]

The overall prognosis of HF in patients older than 65 years of age is, in general, unfavorable. In what comes to mortality, this type of fractures confers a 10 to 20% increased risk of mortality in the first year and this increase remains elevated at least for 10 years after HF.[23] Two recently published prospective studies found 1-year mortality rates of 11.9% and 26%.[24,25] There is some data on this subject in Portugal. Previous studies reported a 3 and 6-month mortality after discharge of 10.2 and 14.1%, respectively.[14] In a study published in 2002, the mortality rate at 1 year was 21.7%.[15] In a retrospective analysis of 120 HF in Coimbra, 36 patients died within 30 months after admission, 11 of these in the first month and 15 during the first year, which constitutes a mortality rate of 12.5%.[26] Another retrospective analysis encountered a 1-year mortality of 14.6% in 267 patients admitted with an HF in a public hospital, although the author admits that there can be some underestimation of this value, because of the methodology used to identify this outcome.[20] In our study 6-months mortality was higher than previously reported, with 17.1% of patients dying before 6 months after a HF. This happened most often in males (31.0% *vs* 14.1%), which is concordant with the international available data and may reveal that the general worse outcome in males can be mainly due to early complications after HF. The 1-year mortality rate in our study was similar to that estimated in other countries but greater than the one reported in previous studies in Portugal.

The main predictors of mortality after HP fracture have been studied and the most classically reported are advanced age, male gender and poor overall health status. In a study in Germany, factors with greatest influence on mortality were postoperative complications, prior history of cancer

and high American Society of Anaesthesiologists (ASA) classification.[27] In a recent study that extended follow-up up of a cohort of HF patients to ten years, other predictors of mortality found were the presence of major postoperative complications, high ASA classification, history of cancer, chronic obstructive pulmonary disorder, history of congestive heart failure, ambulating with an assistive device or being a household ambulatory prior to HF.[24] In our study the outcome factors associated with an increased mortality other than increasing age were total dependency, readmittance to the hospital for any cause, history of subsequent fall, inability to walk again and becoming bedridden after HF. After adjustment for age, the factors associated with mortality were readmittance to the hospital for any cause in both genders and confinement to bed in males and total dependence after the HF in females. This may be explained by the small size of the sample, mainly in the male gender. In contrast, being able to walk again seemed to be protective.

It is well demonstrated that antiresorptive agents are effective in the prevention of recurrent HF.[28] One recent randomized controlled trial was prematurely terminated due to the significant decrease in mortality in patients treated with a bisphosphonate after a HF.[29] In our study treatment for osteoporosis after discharge was also studied, although the assessment of compliance to the treatment depended on the answers given to the questionnaire. According to this, the percentage of patients in which anti-osteoporotic drugs were prescribed after discharge was relatively high, when compared to some previous data.[30,31] In a 2003 retrospective study in a Portuguese population, only 4.5% were medicated with anti-osteoporotic drugs after discharge.[32] In another study made in Portugal using a telephone query, only 14.4% were treated for osteoporosis after a HF.[33] We admit that the high prescription rates encountered in our study may have been due to the knowledge of the existence of an ongoing study, which may have altered the prescription habits of the orthopaedic surgeons with a trend for a more frequent anti-osteoporotic agents treatment prescription. Although this can be seen as a limitation of the study, this is also a sign that prescription habits can be modulated and improved in the hospital setting. Another marker of good management after a HF is the prescription of physical therapy after discharge. Early mobilization and muscle strengthening are important in the management of these patients. In our study, the prescription of physical therapy was relatively infrequent and the compliance was even smaller. This can be due to the high number of patients that became bedridden after this event and also because of the poor general condition and lack of familiar and social support in order to meet the prescribed treatment. In our study the percentage of patients that became bedridden and totally dependent was higher than demonstrated in other studies.[34,35]

In addition to the high mortality rate, the consequences and social costs of treatment and rehabilitation of patients with HF are also important.[36] Even considering the return of patients to their home a sign of remission, the loss of quality of life in the context of their domestic life is often unrecoverable.[37] In general, functional outcome was very poor with a response rate in category 1 (able to do without difficulty) below 15% in most of the questions. In males, the percentages of response in category 4 (unable to do) was over 60% in all tasks, except wash the face and hands, and eat and drink. In females, the global result seemed better, with the same percentage (>60%) of answers in category 4 only as to their ability to take a bath and going up and down stairs. The global functional outcome seemed better in females than males.

One limitation of our study is that this assessment of functional ability is transversal and does not take into account the previous functional status of the patient, which was not studied. Although the current status is poor, it can be possible that patients suffered a decline of their functional status prior to the fracture and this could even be one of the causes for the fracture event. The fact that these patients were all from one centre may diminish its representation on national terms but at the same time allowed a more systematic and unbiased recruitment of patients, because there were no other criteria than age above 65 years old and the presence of an osteoporotic HF. The lack of a control group can also be considered as a possible limitation as it did not allow the study of other variables that can influence the outcomes.

Conclusion

This study reinforces the gloomy outcome that HF may have, both in mortality and morbidity. Twelve-month mortality rates were similar to the esti-

mates obtained in other studies, although the present 6-month was higher. Deaths occurred mainly at the hospital facilities, during the first 6 months after HF. The risk of death was significantly higher in male patients that became bedridden and in females who became totally dependent in their daily living activities. Hospital admission, by any cause was associated with a higher risk of death in both genders. Physical therapy seemed to be protective in males against this outcome. Treatment prescription of bisphosphonates after HF was frequent when compared to other studies. There is a window of opportunity to treat these patients, as it is proven that antiresorptive treatment diminishes the risk of re-fracture and death after HF. The deterioration of health-related quality of life and of the independence in activities of daily living is evident in this study. This physical decline and degree of dependence installed are major factors for low self-esteem and deterioration of health quality.

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