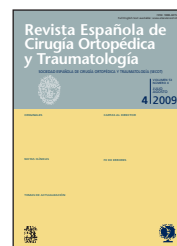


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## ORIGINAL PAPERS

### Hip fractures in the elderly: mortality predictive factors at one year from surgery

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#### KEYWORDS

Fracture;  
Hip;  
Mortality;  
Risk factors

#### Abstract

*Purpose:* To identify factors that could be associated to increased mortality in patients over 60 years of age with a hip fracture that undergo surgery.

*Materials and methods:* This is a prospective study of 90 patients carried out with the aim of identifying what are in our environment the risk factors associated to increased mortality in elderly patients subjected to surgery further to sustaining a hip fracture. Inclusion criteria were as follows: being older than 60 years of age, not having a pathological fracture and staying alive during hospitalization. All patients were followed up for one year or until their passing away. Risk factors analyzed in the study were: age, gender, general health status, mental impairment and functional status prior to fracture, as well as fracture type.

*Conclusions:* Gender and prior health status were the risk variables for which statistically significant differences were observed in terms of mortality at one year. In contrast, age and pre-fracture mental status stayed just below the statistical significant threshold for  $p < 0.05$ . Prior functional status and fracture type were not identified as risk factors.

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**PALABRAS CLAVE**

Fractura;  
Cadera;  
Mortalidad;  
Factores de riesgo

**Fracturas de cadera en ancianos: predictores de mortalidad al año en pacientes operados****Resumen**

*Objetivo:* Identificar los factores que pudieran conllevar un aumento de mortalidad en los pacientes de más de 60 años intervenidos de fractura de cadera.

*Material y método:* Realizamos un estudio prospectivo de 90 pacientes para identificar en nuestro entorno los factores de riesgo relacionados con el aumento de la mortalidad de los pacientes de edad avanzada que, tras una fractura de cadera, fueron tratados mediante cirugía. Los criterios de inclusión fueron: tener más de 60 años, no tener una fractura patológica y no haber fallecido durante el ingreso. Todos ellos fueron seguidos durante 1 año o hasta su defunción. Los factores de riesgo analizados en el estudio fueron: edad, sexo, estado general de salud, deterioro mental y estado funcional previo a la fractura y el tipo de fractura.

*Conclusiones:* El sexo y el estado general previo fueron variables de riesgo que mostraron diferencias estadísticamente significativas para la mortalidad al año, mientras que la edad y el estado mental antes de la fractura quedaron en el límite de significación ( $p < 0,05$ ). El estado funcional previo y el tipo de fractura no se mostraron como factores de riesgo.

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**Introduction**

Yearly mortality rates of patients over 60 years of age who sustain a hip fracture and are treated surgically ranges between 14 and 36% according to the literature reviewed<sup>1,2</sup>. Few studies have attempted to identify the risk factors associated to increased mortality<sup>3</sup>. The literature is not conclusive on the role and the relative contribution of variables existing prior to the time of fracture such as age, sex, comorbidities, functional status, mental impairment, fracture type or the fact of living alone or with other persons. Moreover, the importance of these variables as factors determining survival at 12 months from fracture has been scarcely studied<sup>4-6</sup>.

The purpose of this study is to identify the factors that may be related with an increase in mortality in patients over 60 years of age operated for a hip fracture.

**Materials and methods**

In the period from 1 January and 31 December 1998 a total of 809 patients with a hip fracture were treated in our hospital. To carry out this study, we evaluated the first 20 patients treated every month, which resulted in a total sample of 120 patients. Of these, we were able to assess 90 patients until the end of the study period, i.e. for one year, or until their demise, if that preceded termination of the study. Inclusion criteria were: age over 60 years, not having sustained a pathological fracture and not having died while hospitalized.

Our working hypothesis was to determine whether any variables preceding the fracture could be identified that could act as risk factors for mortality at one year in patients older than 60 years of age with a hip fracture.

The risk prediction variables we analyzed were: age (<83 or >83 years), gender (female/ male), living alone or with other persons, general health status; mental and functional status prior to fracture and type of fracture (stable or unstable).

To assess the patients' general health status we used the scale of the American Society of Anaesthesiologists (ASA). We chose to use this scale because it made it possible for us to establish a surgical risk grading system (1-2 vs. 3-4) and it provided a clearer idea of the severity of the patients' status than an analysis of the number of concomitant diseases.

In order to determine the degree of mental and functional impairment preceding the time of fracture we developed an objective assessment scale (0-1 as compared with 2-3) (table 1 and 2)<sup>7</sup>.

**Table 1** Mental impairment scale

Excellent (grade 0)	Normal
Good (grade 1)	Nearly normal
Fair (grade 2)	Disoriented
Poor (grade 3)	Confusion and dementia

**Table 2** Functional impairment scale

Excellent (grade 0)	Ambulates without assistance
Good (grade 1)	Requires occasional help: walks with a cane
Fair (grade 2)	Daily assistance required: uses 2 canes or a walker
Poor (grade 3)	Bedridden or in a wheelchair

**Table 3** Patient characteristics on admission (n=90)

	N (%)
Age (years)	
≤ 83	52 (57.7)
> 83	38 (42.3)
Females	70 (77.8)
Males	20 (22.2)
ASA classification	
1-2	56 (62.2)
3-4	34 (37.8)
Mental impairment	
0-1	77 (85.6)
2-3	13 (14.4)
Functional status	
0-1	80 (88.9)
2-3	10 (11.1)
Fracture type	
Stable	17 (8.9)
Unstable	73 (81.1)

Age and gender details were gathered from the data furnished by patients on admission. Information on concomitant diseases, mental and functional status and household structure was collected during an interview with the patient or a relative. A radiological study made it possible to determine the type of fracture sustained.

Patients were evaluated at 1, 3, 6 and 12 months by the same observer. The information was collected through objective assessment scales in the course of a telephone interview with the patient or, failing that, with a relative or caretaker.

Patient characteristics are summarized in table 3.

We started by carrying out a bivariate study in order to understand the importance of each variable as a risk factor for mortality in the patients of our study. We considered that there was a statistically significant difference when  $p < 0.05$ .

Using the variables considered clinically important out of those with statistical significance for mortality (age, gender, general health status, precedent mental and functional status and fracture type) we carried out a multivariate logistic regression analysis. In this study, the raw odds ratio (OR) reflects the absolute risk for each variable and describes the probability of death, and the adjusted OR indicates the relative risk for each variable and described the probability of death when the latter is related to the other risk factors.

## Results

We studied 90 patients who sustained a hip fracture between 1 January and 31 December 1998 for one year or until their demise; 16 patients died within the first year from the time of fracture, mortality at 3, 6 and 12 months was 5.5, 9 and 18% respectively. It is worth mentioning that the mortality rate was similar across all 4 trimesters.

The bivariate study (table 4) showed the relationship between mortality and some risk factors. Male gender and

**Table 4** Bivariate analysis. Mortality predictors at one year from fracture

Variable	Mortality	P
Age (years), mean±SD		0.17
≤83	81.06±6.14	
>83	83.31±4.95	
Gender, real/ expected		0.02
Female	9/ 12	
Male	7/ 4	
ASA classification, real/ expected		0.03
1-2	6/ 10	
3-4	10/ 6	
Mental impairment, real/ expected		0.16
0-1	12/ 14	
2-3	4/ 2	
Functional status, real/ expected		NS
0-1	15/ 14	
2-3	1/ 2	
Fracture type, real/ expected		NS
Stable	3/ 3	
Unstable	13/ 13	

SD: standard deviation; NS: not significant.

impairment of the general health status (ASA 3-4) were factors predictive of increased mortality at 1 year from fracture. Age in excess of 83 years and the degree of mental impairment achieved borderline statistical significance, while previous functional status and fracture type were not considered risk factors for mortality at one year from fracture.

A multivariate logistic regression analysis allowed us to determine the importance of each of the variables at stake, both in themselves (raw OR) and when taken together (adjusted OR). The factors studied were those that proved statistically significant in the bivariate study. Table 5 shows odds in favor of dying at one year from fracture with a 95% confidence interval. This table confirms that gender and general health status prior to fracture are significant variables for survival at 12 months; age and mental health status achieved borderline statistical significance; they were only clearly significant when taken together with the remaining variables (adjusted OR). Fracture type was irrelevant for survival at one year.

## Discussion

We have prospectively studied mortality at one year following hip fracture in 90 patients. All patients followed the same postoperative treatment protocol, which consisted in early mobilization and resumption of weight-bearing ambulation at 48h from surgery in order to recover the pre-fracture functional status as soon as possible.

Mortality observed at 12 months was 17.8% which is in line with rates published in other studies<sup>1,2</sup>.

Patients over than 83 years of age had a higher probability of dying during the first year following fracture. Moreover,

**Table 5** Multivariate study. Mortality predictors at one year from fracture

	Raw OR (95%CI)	p	Adjusted OR (95%CI)	p
Age (years), <83/ >83	2.73 (0.9-8.36)	NS	3.77 (1.03-13.83)	0.04
Females/ males	3.65 (1.15-11.58)	0.02	4.59 (1.22-17.34)	0.02
ASA classification, 1-2 vs. 3-4	3.47 (1.13-10.67)	0.03	2.61 (0.77-8.81)	NS
Mental impairment, 1-2 vs. 3-4	2.4 (0.64-9.1)	NS	4.71 (0.94-23.71)	0.05
Fracture type, stable/ unstable	1.01 (0.25-4.03)	NS	1.59 (0.12-2.86)	NS

CI: confidence interval; NS: not significant; OR: odds ratio.

some authors have found that advanced age leads to a increase in mortality<sup>4,8</sup>. In a prospective series of 571 patients, Hannan et al<sup>9</sup> did not find an increase in mortality in older patients. For that reason, we believe that, for the patients operated, age is a risk factor that needs to be taken into consideration.

Gender was a predictive factor for increased mortality when other variables acting as confounding factors were controlled. Similar results were provided by Endo et al<sup>10</sup>, Dzupa et al<sup>11</sup> and Richmond et al<sup>6</sup>, all of whom recently reported a close relationship between mortality at 12 months from fracture and male gender. On the other hand, Aharonof, in a prospective study of 612 patients over 65 years of age, found no connection between age and survival.

Patients with a stage 3 or 4 surgical risk (ASA classification) presented with a higher probability of dying at one year. The majority of authors reviewed show similar results to those found in our study<sup>12,13,14</sup>. We prefer to use the ASA scale because it takes into consideration the severity of the different diseases that may affect survival, whereas the number of comorbidities merely reflects the patients' general health status, without providing an indication of the potential life risk involved.

Mental impairment was a risk factor in our study. A long series of authors reached the same conclusion<sup>5,12,15,16</sup>.

Functional status prior to fracture was a factor predictive of higher mortality in a study by Muraki. For Jensen<sup>17</sup>, functional status was tantamount to the degree of social dependence and found a close relationship between the former and increased mortality. In our study, we did not detect a relationship between functional status prior to fracture and mortality at one year. These same results were reported by Dzupa in a prospective study in 2002. Taking these results into account, we consider that pre-fracture functional status is not a conclusive risk factor.

Fracture type was not a significant risk factor. This is something mentioned by the majority of authors reviewed<sup>14</sup>. On the other hand Muraki, in a retrospective study in 2006, stated that sustaining a pertrochanteric fracture was a risk factor for mortality.

Recently, Parker presented some interesting work where he mentions other variables (preoperative blood transfusion, geographic variability) that could be considered to be risk factors following hip fracture<sup>18,19</sup>.

In our environment, the average mortality rate at one year following hip fracture in patients treated surgically stood at around 17%

As a result of our working hypotheses, we conclude that age over 83 years and significant mental impairment must be considered risk factors for mortality within the first year following hip fracture. The main risk factors were deterioration of general health status and male gender. For that reason, in an attempt to reduce mortality at one year in these patients, our efforts should be aimed at preserving the patients' pre-fracture general and mental status.

## Conflict of interests

The authors have declared that they have no conflict of interests.

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