Hip fracture in Acutely ill hospitalized medical patients
Antonio Zapatero1, Raquel Barba2§, Jesús Canora1, Juan E Losa3, Susana Plaza4, Jesús San Roman5, Javier Marco6
1 Servicio de Medicina Interna, Hospital Universitario de Fuenlabrada, Fuenlabrada, Madrid, Spain
2 Servicio de Medicina Interna, Hospital Rey Juan Carlos, Móstoles, Madrid, Spain
3 Servicio de Medicina Interna, Hospital Universitario Fundación Alcorcón, Alcorcón, Madrid, Spain
4 Servicio de Medicina Interna, Hospital Severo Ochoa, Leganés, Madrid, Spain
5 Departamento de Medicina y Cirugía. Universidad Rey Juan Carlos. Madrid.Spain
6 Servicio de Medicina Interna, Hospital Clínico de San Carlos, Madrid, Spain

§Corresponding author: Raquel Barba
Hospital Rey Juan Carlos
C/Gladiolo s/n Móstoles, 28933, Madrid

Email addresses:
AZ: azapatero.hflr@salud.madrid.org
RB: raquel.barba@hospitalreyjuanCarlos.es
JC: jcanora.hflr@salud.madrid.org
JEL: JELosa@fhalcorcon.es
SP: splaza.hsvo@salud.madrid.org
JSR: jesus.sanroman@urjc.es
JM: javier.marco@elmundo.es
ABSTRACT:
Introduction: The aim of the present study was to analyze the incidence of hip fracture as a complication of admissions to internal medicine units in our country.
Methods: We analyzed the clinical data of 1,989,784 adults who had been admitted to the internal medicine wards. The main outcome was a diagnosis of hip fracture during hospitalization. Outcome measures included rates of in-hospital fractures, length of stay and cost.
Results: A total of 1127 (0.057%) were coded with an in-hospital hip fracture. The rate of in hospital mortality was 27.9%, and the median length of stay was much longer for episodes associated with a fracture (20.75 days vs 9.8 days; p<0.001). Cost were higher in hip-fracture patients (7085€ per hospitalization vs 3789€ in non fracture patients). Risk factors related to fracture were: increasing age (OR 2.32 95% CI 2.11-2.56), female gender (OR 1.22 95% CI 1.08-1.37), nursing home transfer (OR 1.65 95% CI 1.27-2.12), dementia (1.55 OR 95% CI1.30-1.84), malnutrition (OR 2.50 95% CI 1.88-3.32), delirium (OR 1.57 95% CI 1.16-2.14), and anemia (OR 1.30 95%CI 1.12-1.49).
Conclusions: In-hospital hip fracture notably increased mortality and morbidity during admission, doubling the mean stay and mean cost of admission. For that reason, we stress the importance of designing and applying multidisciplinary plans capable to reduce the incidence of hip fractures in hospitalized patients

Key words: Hip-fracture, Hospitalized, Internal Medicine, Morbidity, Mortality, Security
Introduction and Hypothesis

The incidence of hip fracture is increasing throughout the world, due among other reasons to the progressive aging of the population, with the number of people over 65 expected to double in the next three decades.\(^1\) The raw incidence of hip fracture in Spain is 511 cases/100,000 inhabitants a year in patients age 65 or older.\(^2\) Moreover, demographic studies show that hip fractures are more common in institutionalized patients\(^3\) and in patients hospitalized for another cause, in whom the risk can be up to 11 times greater.\(^4\)

When hip fracture occurs as a complication of hospital admission, it can have devastating effects on the patient, producing clinical and psychological consequences, prolonging the hospital stay, increasing mortality and notably raising the cost of hospital care\(^3,5\).

Hip fracture in hospitalized patients has been related to a series of predisposing factors, particularly falls in the hospital.\(^6\) Hitchco \textit{et al.},\(^7\) in a prospective descriptive study of hospital falls, report a rate of falls in medicine and neurology wards of 6.2 per 1000 patient bed days, which is almost 3 times higher than in surgery wards. As the nursing and medical care received is related to the frequency of falls,\(^6\) falls are considered a quality-of-care indicator.\(^9,10\) Hip fracture in postoperative patients was included as an indicator of complications due to the care process during hospital admission by Iezzoni \textit{et al.}\(^11\) in 1992, when they developed the Complications Screening Program (CSP). Hip fracture was later listed as one of the Patient Safety Indicators by the Agency Healthcare Research and Quality\(^12\) and as a safety indicator in the OECD HCQI Project.\(^13\)

Patients admitted to internal medicine units have many of the factors associated with increased risk of falls and fractures during admission, such as advanced age, mobility
problems, cognitive deterioration, occurrence of confusional pictures during admission, polimedication and a high demand for nursing care. 

The aim of the present study by the SEMI Management Group was to analyze the incidence of hip fracture as a complication of admissions to internal medicine units and describe their epidemiological characteristics, including associated risk factors, hospital course, mortality, and impact on hospital stay and cost of care.
Methods

We identified every patient discharged from an Internal Medicine Department from of hospitals of the Spanish Public Health Service between January 1st, 2005 and December 31st, 2008. Hospital discharge data were obtained from the CMBD (Basic Minimum Data Set). This CMBD registry is compulsory for every patient admitted to a hospital of the Spanish National Health Service, a system that cares for more than 90% of the country’s population. All centres submit this information to the Spanish Health Ministry. CMBD contains sociodemographic and clinical data for each documented hospital stay including: gender and age, primary and secondary diagnoses (according to the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code); primary and secondary procedures; admission and discharge status; length of stay; and hospital characteristics (less than 200 beds; 200 to 500 beds; 500 to 1,000 beds; more than 1,000 beds). For every patient, a diagnosis-related group (DRG) was identified. DRGs are a way of classifying patient hospitalizations by diagnosis and procedure on the assumption that similar costs are expended on patients by using similar resources. Each DRG has a relative weight that reflects the intensity of resources consumed. We obtained permission for use the data.

The main outcome was a diagnosis of hip fracture during hospitalization. The indicator was defined as cases on in-hospital hip fracture per 100 medical discharges. Discharges with an ICD-9-CM code for hip fracture in any secondary diagnosis field: 820.00-820.22; 820.30-820.32; 820.8; 820.9. Patients were excluded in MDC 8 (disease and disorders of the musculoskeletal system and connective tissue), cases with principal diagnosis or secondary diagnosis present on admission if known of seizure, syncope, stroke, coma, cardiac arrest, poisoning, trauma, delirium and other psychoses or anoxic brain injury, cases with diagnosis of metastatic cancer, lymphoid malignancy or bone malignancy or self-inflicted injury, MCD 14 (pregnancy, childbirth an puerperium) and if the had conditions suggesting fracture present on admission12.
The Age Adjusted Charlson Co-morbidity Index (CCI) was computed for each patient. This index reflects the number and importance of comorbid diseases, relies on ICD-9-CM categories, and was used to adequately adjust for severity of illness.\textsuperscript{14,15}


DATA ANALYSIS
Differences in the distribution of various demographic and clinical characteristics between patients who presented hip fracture during hospitalization and those who did not, were examined. We used the chi-square test for categorical variables with the Yates correction, and the Fisher’s exact test for dichotomous variables when the expected value of a cell was less than 5, and Student T for quantitative variables. All the univariate analyses were carried out after adjusting for age and gender. The Odds-Ratios (OR) and 95% Confidence Intervals (CI) were estimated from the regression coefficients. The most clinically relevant variables and those with statistical significance (p<0.1) in the univariate analyses of every subgroup were introduced in the logistic regression analyses, to determine independent risk factors for hip fracture during hospitalization.
All statistical analyses were carried out with the use of a SPSS Software version 16.
RESULTS

Between January 2005 and December 2008 the dataset included 2,134,363 episodes. Of these, 1,989,784 (93.2%) met the basic inclusion criteria. A total of 1127 (0.057%) were coded with an in-hospital hip fracture. The median age of in-hospital hip fracture patients was 81.69 years (SD 10.15) and 57.2% were women. An age-adjusted CCI score >2 was present in 1080 (95.8%) of cases. The cost for patients who developed hip fracture during hospitalization was 7085 € (SD 5523), 3296€ higher than median cost (3789€ (SD2450)). The general characteristics of all hospital discharges are summarised in Table 1.

Over 97.6% of episodes were for individuals over 50 years of age (Table 2). The most prevalent comorbidities among in-hospital hip fracture population were: diabetes (24.4%), pulmonary disease (22.4%), chronic heart failure (22%), anemia (21.9%) and dementia (13.8%)(Table 1). Malnutrition and dementia were the major comorbid conditions associated with in-hospital hip fracture (4.5% vs 1.5%; OR 3.13 95%CI 2.36-4.14, and 13.8% vs 5.9%; OR 2.56 95%CI 2.16-3.03; p<0.001 for both). There were also a higher proportion of episodes with a comorbid diagnosis of delirium among in-hospital hip fracture patients, compared with the total population (3.8% vs 1.8%; p<0.001). Anemia (21.9% vs 15.4%; p<0.001), and chronic cerebrovascular disease (9.8% vs 7.9%; p=0.02) were also associated to in-hospital hip fracture.

The median length of stay was longer for episodes associated with a fracture (20.75 days vs 9.8 days; p<0.001). Hospital characteristics of these patients are summarised in table 3. Emergency admissions accounted for most of the episodes in which fracture occurred (88.2%), although the risk of hip-fracture was higher in elective admissions (OR 1.63 95%CI 1.36-1.95). Admission from nursing home accounted for the highest volume of episodes, with a double risk for hip-fracture than home-admissions (OR 2.73 95%CI 2.11-3.50).
A total of 314 (27.9%) patients with in-hospital hip fracture die during the hospital stay. Dying patients were older (84.2 years (SD 8.3) vs 80.1 years (SD 10.8); p<0.001), and had higher levels of co-morbidity (CCI index > 2, 97.4% vs. 94.7%; p=0.002).

In the logistic regression model the strongest associations with fracture were:

- increasing age (OR 2.32 95% CI 2.11-2.56),
- female gender (OR 1.22 95% CI 1.08-1.37),
- nursing home transfer (OR 1.65 95% CI 1.27-2.12),
- dementia (1.55 OR 95% CI 1.30-1.84),
- malnutrition (OR 2.50 95% CI 1.87-3.32),
- delirium (OR 1.57 95% CI 1.16-2.14),
- and anemia (OR 1.30 95% CI 1.12-1.49). (Table 4)
DISCUSSION

After analyzing more than 2 million cases, we found an incidence of hip fractures in patients admitted to internal medicine of 0.58 per 1000 admissions. In a Spanish study of postoperative patients using the same methodology, the rate of hip fracture was 0.1 per 1000 patients operated.\textsuperscript{16} Therefore, hip fracture as a complication of admission was almost 6 times more frequent in patients admitted to internal medicine than in those undergoing surgery. The risk factors associated with this complication were age, female sex, dementia, confusional syndrome, malnutrition, comorbidity and admission from a nursing home. The most evident consequences of hip fracture were a two-fold increase in hospital stay, a three-fold increase in mortality and a two-fold increased in cost per admission compared to patients without hip fracture.

Studies by other authors had already underlined the relevance of hip fracture as a complication in postoperative patients. In a study made in England, Raleigh \textit{et al.}\textsuperscript{17} report that hip fracture in postoperative patients produces an excess hospital stay of 17.09 days and excess mortality of 18.20\%. Brand \textit{et al.}\textsuperscript{18} reviewed the administrative data of public hospitals of the state of Victoria, Australia, for a period of 10 years. They report an incidence of hip fracture in hospitalized patients of 0.14\%, which remained stable for the duration of the study. The presence of hip fracture was associated with a 30\% increase in mortality and a 4-fold increase in the hospital stay. Johal \textit{et al.}\textsuperscript{5} demonstrated that the mortality of patients with hip fracture occurring in the hospital was 18\% at 30 days and 47\% after 1 year, twice as high as the mortality of patients with hip fracture occurring in the community.\textsuperscript{5} Most hip fractures occurred in medical and geriatric units, in fragile patients with cognitive impairment and more comorbidities, as also occurs in our series.
From the previous study of Australia, when hip fractures that occur in the hospital were compared to those that occur in the community, a two-fold increase in hospital mortality, a greater need for referral to social and health centers at discharge and much lower percentage of recovery of pre-fracture activities of life has been reported.\textsuperscript{19} In a European study, Foss \textit{et al.}\textsuperscript{20} included 44 consecutive patients with hip fracture that occurred in the hospital, a figure equivalent to 7\% of all in-hospital fractures; these patients had a worse functional level and more comorbidities before the fracture and a significantly worse postoperative evolution, with a two-fold longer hospital stay and mortality during admission. It should be noted that half of the patients in this series had a previous history of falls and 75\% of these patients suffered the fracture in the two first weeks of admission to an acute care unit, so it can be concluded that this phase of admission should be targeted for reinforced fall prevention measures.

The risk factors associated with falls are usually multifactorial in older adults. Some risk factors are associated with the aging process, such as difficulty in maintaining balance while walking and impaired vision, whereas others are related to previous diseases, extrinsic factors and, one of the most important, to medications (sedatives, sleeping medications, vasodilators, diuretics, etc).\textsuperscript{6} In our study, frequent risk factors for hospital hip fracture were the presence of dementia, confusional syndrome and malnutrition. Interventions designed to reduce the predisposing factors of delusion and confusion have been shown to be useful. Maracantonio \textit{et al.},\textsuperscript{21} using a geriatric survey model in surgical patients with hip fracture, were able to reduce the incidence of delusion by almost 30\%. With respect to malnutrition, other authors\textsuperscript{22} have previously considered the utility of a nutritional intervention in patients admitted with hip fracture, indicating that this intervention helps to reduce the total number of days with delusion, the occurrence of pressure sores and hospitalization time.
In this study individuals living in institutions were almost two times more likely to sustain a hip fracture than those living in private homes. Institutionalized older people have increased high levels of chronic illness, medication use, cognitive disorders and impairments of vision, strength and neuromuscular functioning. Such individuals may be less exposed to the sun than those living in private homes and may have lower levels of vitamin D, thus placing them at increased risk of osteoporosis and possible muscle weakness.

Fall prevention requires multidisciplinary strategies, which should first include adequate screening of patients to identify those at risk, a suitable protocol for the prevention of falls during admission, early intervention of delusional syndrome and proper drug prescriptions in these patients. Structural measures, such as changes in room and bath furnishings, should also be implemented, and it is important to train nursing and medical personnel to recognize the risk factors for this complication.

The limitations of our study are related to the fact that it is an administrative database in which some cases of hip fracture may not have been entered in an effort to protect the reputation of physicians or the hospital center, or simply because the description of the complication is not very specific and cannot be properly interpreted. Nevertheless, given the clinical importance of hip fracture, it is unlikely that it will be omitted from the hospital discharge report. Another noteworthy limitation is that the administrative database used did not include the treatments received by patients during admission.

**Conclusion**

In the present study we report the incidence of hip fractures during hospital admissions to Spanish internal medicine units, which was almost 6 times higher than in patients who undergo surgery. In-hospital hip fracture notably increased mortality and morbidity during admission, doubling the mean stay and mean cost of admission. For that
reason, we stress the importance of designing and applying multidisciplinary plans capable to reduce the incidence of hip fractures in hospitalized patients.

**Competing interests**

The authors declare that they have no competing interests

**Author’s contribution**

All authors contributed to the design and conduct of the study and read and approved the final manuscript.

Raquel Barba: had the idea of this paper, she did all the statistical analysis and work with the results.

Antonio Zapatero is the coordinator of the group and, as president of the Group of Medical Management of the SEMI (Sociedad Española de Medicina Interna – Spanish Society of Internal Medicine) was the official liaison with the Spanish Ministry of Health for the procurement of the crude data.

Javier Marco confectioned the first draft and its final version for the approval of the other authors.

Susana Plaza help to obtain some meaning from the massive amount of results obtained from the raw data.

Juan E Losa did all the pertinent crosses between partial results in order to achieved final results with statistical significance.

Jesús Canora helped write the discussion of the paper and made the bibliographic revision.

Jesús SanRomán did the bibliographic revision.

**Acknowledgments.**

The authors thank the Spanish Minister of Health for the permission to obtain of the data.


(9) Myint PK, Poole KE, Warburton EA. Hip fractures after stroke and their prevention. QJM 2007; 100(9):539-545.


(12) AHRQ. AHRQ Quality Indicators Web Site. 2011.


CONFLICT OF INTEREST:

None declared
Additional files provided with this submission:

Additional file 1: hip TABLE 1.doc, 37K
http://www.biomedcentral.com/imedia/1153877725718655/supp1.doc
Additional file 2: HIP TABLE 2.doc, 28K
http://www.biomedcentral.com/imedia/5194771357186552/supp2.doc
Additional file 3: HIP TABLE 3.doc, 26K
http://www.biomedcentral.com/imedia/1395654422718655/supp3.doc
Additional file 4: hip TABLE 4.doc, 29K
http://www.biomedcentral.com/imedia/2434909187186552/supp4.doc