



# Mortality after hip fracture in the elderly: The role of a multidisciplinary approach and time to surgery in a retrospective observational study on 23,973 patients



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## ABSTRACT

**Background:** Since most hip fractures occur in fragile patients, an important step forward in the treatment may be a co-managed, multidisciplinary treatment approach with orthopaedic surgeons and geriatricians. This multidisciplinary care model (MCM) is implemented in some Tuscan hospitals, while in hospitals with the usual care model (UCM) medical consultation is required only as deemed necessary by the admitting surgeon.

The primary aim of this study was to assess the effect of the MCM on 30-day mortality, compared with the UCM.

**Methods:** A retrospective study was conducted on patients with main diagnosis of hip fracture, as reported in the hospital admission discharge reports, aged 65 years and older, who underwent surgery in Tuscan hospitals from 2010 to 2013. A multilevel logistic regression model was performed to assess the effect of the MCM vs the UCM. The Charlson Comorbidity Index (CCI) was used as a proxy for case mix complexity.

**Results:** 23,973 patients were included: 23% men and 77% women; the mean age was 83.5 years. The multilevel analysis showed that mortality was significantly higher in the UCM, after adjusting for gender, age, comorbidity and timing of surgery (OR = 1.32; 95% CI 1.09–1.59;  $p = 0.004$ ). Surgical delay was not significantly associated with higher mortality rates.

**Conclusions:** A co-managed approach to hip fracture, with orthopaedic surgeons and geriatricians, offers a multidisciplinary pathway for the elderly and leads to a reduction in mortality after hip fracture surgery.

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## 1. Introduction

Hip fractures are a growing public health issue and one of the most serious injuries affecting elderly people. The incidence of hip fracture increases with age and it is already the second most frequent cause of hospitalisation in elderly people (Wilkins, 1999; Kates, Mendelson, & Friedman, 2010). The number of hip fractures is huge in Europe, with more than 500,000 fractures per year (Dettoni, Peveraro, & Dettoni, 2012). An Italian study conducted in

2006 reported that the incidence rate of hip fractures in Italy was about 1.4 fractures/1000 inhabitants/year, and ranged from 6.5 to 7.5/1000 individuals aged over 65 (Laforgia, Maggi, Bianchi, Crepaldi, & Marzari, 2006).

Mortality after hip fracture surgery is higher compared with that observed in sex- and age matched general population; it remains higher in the first year after fracture with an estimated mortality range between 14% and 36% in different studies. (Haentjens et al., 2010; Gdalevich, Cohen, Yosef, & Tauber, 2004; Zuckerman, 1996).

International Guidelines for hip fracture care suggest that patients should undergo surgery within 24–48 h of hospital admission [NICE Clinical Guidelines No. 124. The Management of Hip Fracture in Adults. London: Royal College of Physicians, 2011]; however, the role of surgical delay in mortality remains unclear

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(Gdalevich et al., 2004; Haentjens et al., 2010; Simunovic, Devereaux, & Bhandari, 2011). In recent studies a shorter time to surgery has been associated with a lower complication rate and shorter length of stay, while the association between time of surgery and mortality is controversial (Librero et al., 2012). Anyway, a surgery delay due to clinical reasons is sometimes necessary to evaluate and stabilise patients with significant comorbidities. Since most hip fractures occur in frail older patients, a co-managed care performed by orthopaedic surgeons and geriatricians may constitute an important step forward in the treatment of this condition (Biber et al., 2013; Flikweert et al., 2014).

Geriatricians may be able to identify and reduce the risk of functional decline, long-term care needs and death, thus improving outcomes for elderly patients undergoing hip fracture surgery (Friedman, Mendelson, Kates, & Bingham, 2009). This model differs from the usual management of hip fracture, where medical consultation is required only as deemed necessary by the admitting surgeon (Della Rocca et al., 2013).

An orthogeriatric approach has been implemented in some Tuscan hospitals in different time frames between 2006 and 2009. So, the primary aim of this study was to investigate whether the implementation of a co-managed care model can significantly reduce 30-day mortality rate. This study assessed the independent contribution of the model of care to patients' mortality, after adjustment for baseline differences in patients' characteristics. The role of time to surgery on 30-day mortality was also examined.

## 2. Materials and methods

### 2.1. Data source

This study was conducted in accordance with the Helsinki Declaration.

Data were obtained from different administrative databases in the Tuscany region: hospital discharge abstract (HDA) which contains up to six diagnoses and clinical procedures (The International Classification of Diseases, 9th Revision, Clinical Modification [ICD-9-CM]) and demographic data, Emergency Department Records (EDR) that collect data on all visits, drug dispensing records coded using Anatomical Therapeutic Chemical (ATC) codes for drug classification (the ATC system is the drug classification system adopted by the World Health Organization) and Inhabitant Registry (IR) with demographic information (birthdate and death date where applicable). All the administrative databases were linked through an anonymous patient identifier.

### 2.2. Study population

We conducted a retrospective observational study on patients resident in Tuscany, with principal diagnosis of hip fracture (diagnosis code 820.0x – 820.9x), aged 65 years and older, undergoing surgery at regional public hospitals from 1st January 2010 to 31st December 2013. We included in the study the first episode of hospital admission for hip fracture, happening within a 4-day timeframe. The fracture date was defined as the hospital admission date or the access to ED date, where applicable.

Surgery treatment was evaluated during the first hospital admission and during any subsequent ones occurring within 4 days, and was identified using the procedure codes of unilateral or total hip arthroplasty, internal fixation of fracture of trochanteric or subcapital femur, hemiarthroplasty of fracture of subcapital femur, open and closed reduction of fracture of femur with fixation (procedure codes 7855, 7915, 7935, 8151, 8152).

Exclusion criteria were incorrect anonymous patient identifier, multiple significant trauma (DRG 484–487), *peri*-prosthetic fracture around prosthetic joint (996.44), pathologic fracture of

neck of femur (733.14), secondary malignant neoplasm of bone and bone marrow (198.5), malignant neoplasm and leukaemia (ICD9CM 140.xx–208.xx) within 2 years, admissions to hospitals with a volume of hip fracture of less than 50 per year.

### 2.3. Outcome

The outcome was 30-day mortality after hip fracture, defined as the difference between fracture date and death date, as recorded in the IR.

### 2.4. Patient and treatment characteristics

Three age categories were defined based on the actual age at injury including 60–74 years, 75–84 years and  $\geq 85$  years. The three-level Charlson Comorbidity Index (CCI) was used as a proxy for case mix complexity (Deyo, Cherkin, & Ciol, 1992). To assess patients' comorbidities, all diagnoses coded in the hospital discharge records and in those of the previous 5 years were considered. Anticoagulant and antiplatelet therapy was evaluated in the three months before the fracture date as recorded in drug dispensing records (ATC codes B01AA e B01AC).

Time to surgery was defined as the time between fracture date and the day of the surgical procedure and was divided into categories for exploratory analysis: less than 48 h (early surgery) and more than 48 h (late surgery).

### 2.5. Hospital characteristics

We conducted a survey on hospitals organisational aspects (referred to the whole period 2010–2013), by sending a questionnaire via email to the hospital management staff. So, two different organisational models were identified: the *multidisciplinary care model*, with co-management of geriatricians and orthopaedic surgeons, and the *usual care model*, where geriatricians are consulted for the management of medical conditions and complications as they occur. Length of stay was defined using the HDA.

### 2.6. Statistical analysis

Descriptive statistics and the univariate test of association were used to evaluate differences in study populations. To account for clustering of patients within hospitals, a multilevel logistic regression model (with a random intercept) was performed to assess the effect of clinical and organisational factors on 30-day mortality, with hospitals as second-level units. The following covariates were considered: time to surgery, patient-related factors (gender, age, CCI) and, at hospital-level, organisational model (multidisciplinary care or usual care). Three- and two-term interactions between CCI, time to surgery and organisational model were also tested.

Analyses were performed using STATA 12 (StataCorp LP 4905 Lakeway Drive College Station, Texas 77845 USA).  $P$  value  $< 0.05$  was considered statistically significant.

## 3. Results

Table 1 shows baseline characteristics of patients with hip fracture, timing of surgery and 30-day mortality rate classified into usual care and multidisciplinary model groups. 35 admissions were excluded because of wrong patient identifier.

23,973 Tuscan patients were included in the study: 5522 men (23%) and 18,451 women (77%). Mean age was 83.5 years (SD 7.1). Almost half of all patients were older than 85 years and only 12% were under 75. About 32% of patients had a CCI  $\geq 1$ ; congestive

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