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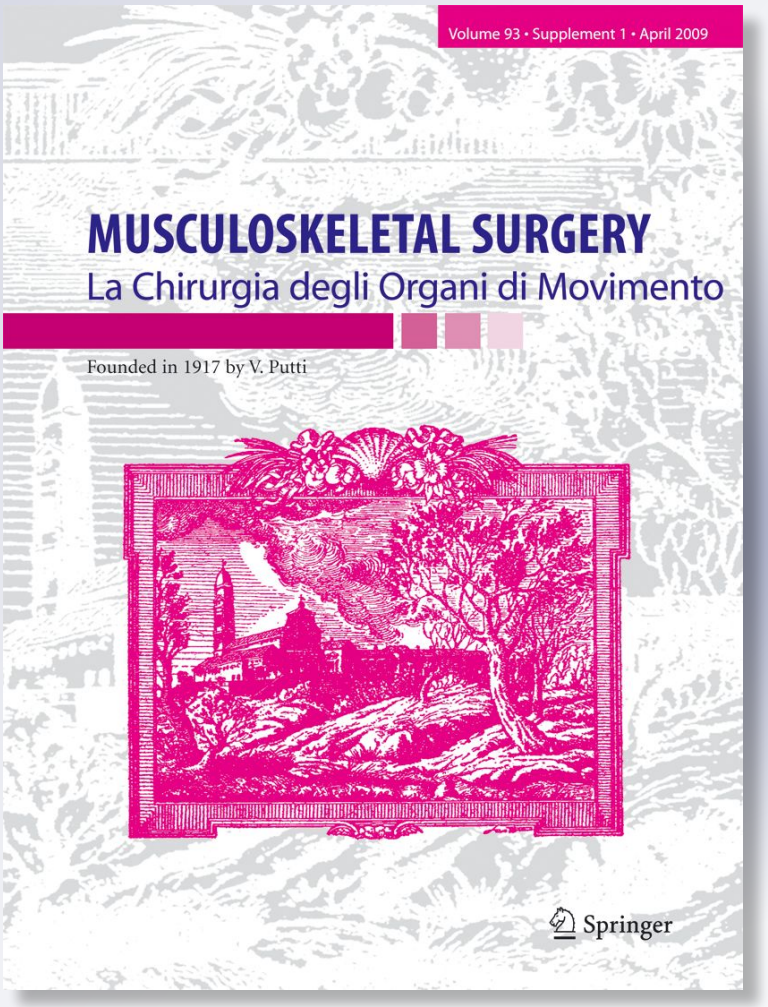

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ORIGINAL ARTICLE

Epidemiology of hip fractures in northwestern Italy: a multicentric regional study on incidence of hip fractures and their outcome at 3-year follow-up

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Abstract Piedmont is a region in northwestern Italy counting 4.2 million inhabitants. The purpose of our study was to update data on incidence and outcomes of hip fractures (HF) in our region to present days. The data of all patients affected by HF in 2003 in Piedmont (total: 5,386 patients) were analyzed, determining the incidence of HF, mean age, sex, fracture pattern and treatment adopted. Additionally, 564 patients underwent a questionnaire on comorbidities, complications, functional outcome and survivorship. Overall incidence of HF was 126.13/100,000 inhabitants-year. Mean hospitalization was 13.67 days. Mean time to surgery was 2.67 days. Survivorship was 94% at 3-month, 71.32% at 1-year and 60.21% at 3-year follow-up. These up-to-date data on HF in our region are in accordance with the international literature and could prove useful for Orthopaedic and Trauma surgeons for giving information to patients and their relatives.

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Introduction

Hip fractures (proximal femur fractures, involving the cervical and trochanteric regions) are highly common among elderly people throughout the world, and Piedmont, a region in northwestern Italy counting 4.2 million inhabitants, makes no exception. The incidence of hip fractures (HF) is high in people aged more than 60 years and requires an expensive medical and surgical treatment [1, 2].

Incidence of HF is rising in the whole world, in pair with the increase in mean age of population. According to the data in the literature, 1.7 million people are affected by HF every year throughout the world. The amount of HF is huge in Europe too, with more than 500,000 fractures per year, and it has been predicted that there will be 750,000 fractures by the year 2030 and 1 million in 2050, while incidence in the world will be 6.26 million then. It has also been reported that in Western countries mortality due to HF has outnumbered gastric and pancreatic cancer, and the risk of experiencing a HF is higher than being affected by breast tumor in women and prostatic tumor in men [3–6].

The economic burden related to the treatment of patients affected by HF, medical care and rehabilitation is heavy. P.Piscitelli stated at the 89th S·I.O.T. (Società Italiana di Ortopedia e Traumatologia—Italian Society of Orthopaedics and Traumatology) Annual Meeting, held in Naples in 2004, that the economic costs of HF are higher than the ones related to myocardial infarction, reaching up to 1 billion euros per years.

We performed this study to investigate the actual incidence of HF in our region and compare this to data retrieved from the literature.

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Materials and methods

This study was divided into two parts and was driven in cooperation between the Orthopedic Divisions of three Hospitals of the region: Mauriziano Umberto I Hospital—Turin, Cardinal Massaia Hospital—Asti and S. Lazzaro Hospital—Alba.

For the first part of the study, the regional database of hospital discharge charts was searched for data related to all HF patients (based on the DRG—Disease Related Groups: ICD-9-CM codes 820.0, 820.1, 820.2, 820.3, 820.8, 820.9, 821.1) treated during the whole year 2003 (January 1 to December 31) in the region, recording age, sex, fracture type and treatment method for all patients (for a total of 5,386 patients).

These data were compared to the general population of the region, thus obtaining the incidence and prevalence of HF in the region. In order to avoid the influence of differences in age and sex composition of the two groups, we performed a standardization by age (dividing patients into three groups: younger than 60 years of age, 60–80 years of age and above 80 years of age) and by sex with the direct standardization method, using the whole population as "reference population".

The second part of the study was driven on a subpopulation of these patients, composed by 564 patients (about 10% of total), that underwent a deeper enquiry, by recording more data through the evaluation of hospital charts and a telephonic questionnaire. The following data were recorded: hospital stay (time to surgery + time to discharge after surgery), comorbidities, drug assumption/medical treatment prior to hospital admission, incidence of complications (at the site of surgery, and neurological, cardiological and pneumological complications). Concomitant pathologies that were taken into consideration were the following: neurological diseases such as Alzheimer's disease or stroke, cardiovascular diseases (cardiac decompensation, arrhythmia, myocardial infarction, atrial fibrillation and angina pectoris), diabetes and thyroid diseases, airways diseases (chronic bronchitis, emphysema, respiratory insufficiency) gastro-enteric pathologies (peptic ulcer, colitis, hepatic diseases) and tumors. All patients underwent a telephonic questionnaire between December 2006 and February 2007 to investigate the incidence of refractures, functional recovery, walking autonomy recovered and survivorship of patients (follow-up for every patient: 3 years; no event happened more than 3 years after the operation was recorded).

We measured the mortality rates of this population, evaluating differences between groups and incidence of the different parameters (age, sex, comorbidity, type of fracture, timing for surgery) taken into consideration.

In order to perform a correct evaluation of the data, mortality was compared to the mortality charts of the general population of our region (courtesy of ISTAT: Istituto Nazionale di Statistica—National Statistical Institute).

All patients enrolled in the second part of the study gave an informed consent to be included in the study. The study was performed in accordance with the Ethical standards of the 1964 Declaration of Helsinki as revised in 2000. No ethical committee was questioned, since this observational study could be of no harm for the patients.

Statistical analysis was performed using the Minitab software (14.2 version). Minitab is a statistical analysis and graphic software projected for the approach to Six Sigma methodology (a method to reduce variances in every type of process). Each procedure offers much information on the measurement system. All tests help understanding how the variables influence measurements. Statistical analyses are based on the ANOVA (analysis of variance) table that considers significance of analyzed values (P-value, χ^2) and of impact on them of confounding variables [7].

Results

In 2003, the total population of Piedmont was 4,270,215 inhabitants. People aged between 60 and 80 years ("young old") were 981,925 (445,940 men, 535,985 women), while the "old elderly", aged above 80 years, were 231,772 (73,033 men, 158,739 women): The total of "elderly" people (namely: aged above 60) was 1,213,697 inhabitants. In 2003, the total amount of hip fractures was 5,386: The incidence of HF among the whole population was therefore 126.13/100,000 inhabitants-year. Women were 76.69% of all patients affected by HF (4,131 out of 5,386), while male patients were 23.30% (1,255 patients). Grouping patients according to their gender, the female total population of Piedmont showed an incidence of 187.40/100,000 inhabitants-year, while the male population had an incidence of 60.72/100,000 inhabitants-year; therefore, incidence appears to be more than three times higher in women than in men (ratio 3.08:1).

Table 1 shows incidence of HF per 100,000 inhabitants per year among the population grouped according to age and gender. In people aged less than 60 years, HF are uncommon (9.72/100.000 in-year), and the male gender is significantly at higher risk of HF. In the "young old" population (60–80 years old), the incidence of HF is 103.47/100,000 in-year, while in the "old–old" population (above 80 years of age) it is 1,757.33/100,000 in-year, i.e., 1.7%. Incidence is higher for men under the age of 60 (12.93 vs. 6.43), while it becomes significantly higher for

Table 1 Incidence of HF per 100,000 inhabitants per year among the population grouped according to age and gender

Incidence/100,000 inhabitants-year				
Age (years)	<60	60–80	>80	Tot
Male	12.93	88.35	905.07	60.74
Female	6.43	116.05	2,149.44	187.43
Tot	9.72	103.47	1,757.33	126.13

Table 2 Timing of hospitalization

	Timing	
	Mean (days)	Range (days)
Hospital stay	13.67	3–60
Time to surgery	2.67	0–35
Time after surgery	11.01	1–41

Table 3 Comorbidities, detected at hospital admission

Comorbidities (%)	
None	36.15
Neurological diseases	20.26
Cardiovascular diseases	14.82
Endocrinological diseases	10.74
Airways diseases	8.06
Gastro-enteric diseases	5.44
Tumor	6.37

Table 4 In-hospital complications

Complications			
Pulmonary (%)	Cardiovascular (%)	Neurological (%)	Local (%)
44.23	26.59	10.74	8.14

women in "young old" population (116.05 vs. 88.35), and in the "old–old" population (2,149.44 vs. 905.07).

The type of injury that caused the HF was the following: in 61.34% of cases an accidental fall at home, in 30.10% a fall outdoor and in less than 9% (8.56%) other causes, such as road car accident, a job accident or a pathologic fracture.

In 47.18%, fracture involved the neck and/or head of the femur (medial fractures), and mean age of patients affected by a medial fracture was 79.82 years old, while lateral fractures (trochanteric region) represent 52.81% of total, and mean age of lateral fracture patients was 81.23 years.

The treatments adopted were as follows: osteosynthesis (intramedullary nailing, screw plate or cannulated screws) in 57.88% patients, partial hip replacement (mono- or bi-articular, cemented or cementless) in 25.76% and total hip replacement in 6.79%. In less than 10% (9.46%) of the patients, the non-surgical option was preferred.

The mean hospitalization was 13.67 days, ranging from 3 to 60 days. Mean time to surgery (waiting time before operation) was 2.67 days (range 0–35); 56.42% of all patients were operated within 2 days from admission (Table 2).

Regarding comorbidities, 36.15% of all patients presented no associated pathology, while 39.62% was affected by one pathology prior to the operation, 17.84% by two and 6.39% had three or more comorbidities (Table 3).

After surgery, 38.78% of patients showed a complication: The complete list of these complications is reported in Table 4.

The incidence of re-fracture (a new fracture in patient that sustained a prior HF) was 2.28% in the same femur (fracture of the distal femur or about the prosthesis/mean of synthesis) and 5.48% in the contralateral hip at 3-year follow-up. The incidence of a new fracture in any other bone was 13.01% at 3-year follow-up. In the questionnaire, the re-fractured patients were asked whether they had taken a treatment for osteoporosis in the interval between the two traumatic events, but only 5 patients could correctly reported a treatment; therefore, no conclusion can be drawn due to the small number of patients eligible.

After hospital discharge, 48.14% of all patients were transferred to a rehabilitation facility for prosecution of deambulatory recovery, 24.68% returned to the nursing home where the patient was already hosted before fracturing the hip or was transferred to a new rest home and only 27.17% returned directly at home; 38.33% of patients returned to walk as before fracturing, with no need for walking aids, and 35.20% returned to walk aided by walking devices (35.67% one stick, 30.78% two crouches, 16.32% trotter, 17.23% wheelchair).

Regarding mortality, 6% of patients died at hospital stay. Survivorship at 3 months is 94%, at 1 year is 71.32%, 66.59% at 2 years and 60.21% at 3 years after treatment (Table 5).

Discussion

The purpose of this study was to depict the status of femoral fracture epidemiology in Piedmont at present times, as accurate as possible, and try to identify any topic in HF treatment that can be implemented or further evaluated for a better management of this pathology.

Every year, in our region, one out of 50 over-eighty is affected by a HF, and incidence among female population is three times higher than in male population [6]. These data are consistent with the ones in Italian and international literature and should be taken into consideration for the

Table 5 Survivorship (and mortality) at 3-year follow-up

Survivorship				
In-hospital	3 months	1 year	2 years	3 years
94% (mortality 6%)	85.41% (mortality 14.59%)	71.32% (mortality 28.68%)	66.59% (mortality 33.41%)	60.21% (mortality 39.79%)

social and economic aspects of the problem. The dimensions of this problem, in terms of people involved in this pathology's management either on the patients' side (patients, families) or on the caregiving side (physicians, paramedics, caregivers), and in terms of monetary and social costs, is huge, and any measure worth reducing these numbers (osteoporosis therapy, patient's education, complications prophylaxis) is warmly welcome and should be taken into serious consideration.

Hospitalization lasts mean 13.67 days, as reported in a recent study by Rossini and Piscitelli (Reumatismo 2005), which described a mean hospitalization of 14 days [8]. No report in literature describes the correlation between duration of hospital stay and outcome of treatment for HF, nor did our study find any correlation.

38% of our patients returned to pre-trauma walking ability with no aiding devices, 35% returned to walking with any device (cane, cruches or trotter), while 27% did not return to walking after surgery. In our study, no correlation was found between any of the parameters considered and the grade of recovery of walking ability ($P > 0.05$). No study in literature reports such a correlation, to our knowledge. Patients that were not operated did not return to walk: This constitutes no news, being the declared goal of this treatment option not a recovery of walking ability but only pain relief [9, 10].

The role of comorbidities on outcome of HF is still controversial.

Some studies report the presence of two or more comorbidities before trauma to play an important role on patient's management, treatment, outcome and mortality [11–13]. Geiger et al. observed in a population of 283 HF patients that only arrhythmia and cerebral diseases modify the mortality rate at 1-year follow-up. In all other cases, comorbidities have to be four or more, in order to influence the mortality rate, raising it to 78% [14]. Press and Grinshpun describe a study on 102 patients, reporting that the cognitive status, hospitalization and comorbidities are the three main factors that influence the outcome of rehabilitation and functional recovery [15]. Nevertheless, HF determines in many cases a significant decrease in function and walking ability. This has been observed by Boonen, in a study on functional outcome and quality of life after HF, that reported a mean 24% decrease in functionality, as defined by the RDRS-2 (Rapid Disability Rating Scale version 2) [16].

In our study, comorbidities are not responsible for an increased mortality rate. This is probably partly due to the fact that only 7% of our sample was affected by three or more comorbidities at the time of admission. Patients affected by HF show a significant increase in mortality compared to the healthy general same age population [21]. In a study carried out at the Rizzoli Hospital in Bologna (Italy) by Spina et al. in 2004, a significant upward in mortality was detected comparing patients affected by HF and general population, matched by age, gander and comorbidity [17]. In Piedmont, in-hospital mortality was 6%, 15% at 3 months after treatment, 29% at 1-year follow-up, 34% at 2-year and 40% at 3-year follow-up. Thus, survivorship is 71% at one year after the occurrence of HF and 60% at three years. These data are in accordance with national epidemiological data previously reported in Italy and in the USA [4, 10–13].

We focused particularly on negative prognostic factors that influence the outcome of treatments for HF in elderly patients. The significant factors were the following: time to surgery, oral anticoagulant therapy previous to admission, cardiovascular and respiratory complications [10, 11, 18–23].

In literature, the advice to perform surgery within 24 or 48 h from admission is still controversial. Many papers reported that postponing surgery more than 24 h raises the mortality rate (even if this can be biased by many factors, including the surgical treatment and its grade of urgency), while others showed no significant difference in patients operated within or after 72 h from admission [18–23]. According to Amer, the most effective predictor for recovery is time to surgery; in his study on 850 HF patients, the ones operated no more than 48 h after admission obtained better results than patients operated later, in terms of functional recovery, walking ability, hospitalization and pressure sores [19]. Christopher and Moran demonstrated in 2005 that surgery should be preferably performed within 48 h from admission, but even a 4-day delay does not cause a significant increase in morbidity, residual impairments or mortality, while a significant increase in mortality at 3- and 12-month follow-up is detected in patients operated more than 96 h after admission [21]. In a recent meta-analysis by Shiga e Wajima, it is reported that all surgical treatments should be performed within the first 48 h, even if it is outlined how difficult this can be in many cases [22].

Oral anticoagulant/antiplatelet drugs play often a main role in taking the decisions on timing for surgery, because the surgeon has often to postpone surgery in order to allow normalizaton of coagulatory parameters. Assumption of drugs inhibiting the coagulatory function has been shown to be a negative factor in HF outcome, as reported by Bansal and Watson [23, 24]. These data, in accordance with our findings, suggest patients on anticoagulant/antiplatelet therapy to be accurately evaluated and alternative treatment options (e.g., drug reversal) to be considered.

Postoperative complications have a negative influence on outcome of HF too: Paksima and Koval [11] reported in a recent study on negative prognostic factor in HF of the elderly that postoperative complications, particularly cardiovascular and respiratory diseases, rise the mortality to almost twice (90% increase), compared to non-complicated cases: Our study reported similar data. We therefore suggest a careful postoperative monitoring of patients at risk of respiratory and cardiovascular complications, in order to prevent these complications to occur.

Only one out of four of our patients returned directly at home after hospital discharge, and nearly half of all patients were transferred to a rehabilitation facility for prosecution of deambulatory recovery; nearly one-third of the patients returned to walk as before fracturing, one-third returned to walk aided by walking devices and one-third did not return to walk. These data are in line with the (scarce) data present in the literature [25, 26].

In conclusion, we can affirm that the data we recorded in our region in 2003 are in high accordance with epidemiological data in other Italian regions and international literature. Considering the data referring to treatment outcomes and particularly survivorship, the dimensions of this problem are those of a "silent epidemic". Social and economic costs related to its treatment raise HF as one of the most relevant problems for Healthcare System and particularly for Orthopaedic Divisions.

The data we collected, particularly those regarding complications, outcomes and mortality, should be taken into consideration by Surgeons involved in trauma care in our region, but also in other regions throughout Italy, when dealing with all tasks and decision that an HF requires and when talking to patients affected by HF and their relatives.

Conflict of interest None.

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