Hospitalized wrist fractures in France: Incidence and burden trend changes

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KEYWORDS
Wrist fractures; Hospitalization; Incidence; Osteoporosis; Costs; France

Summary
Introduction: The aim of this study was to assess the burden of hospitalized wrist fractures between 2002 and 2006 in France.
Methods: Data were drawn from the French Hospital National Database. The number of admissions and the incidence rates were described as well as the type of entry and discharge from hospital, length of stay, and 2006 in-patients costs.
Results: In 2002 and 2006, 38,710 and 38,979 hospitalizations for wrist fractures were registered respectively. The incidence rate of fractures increased with age whatever the year and decreased significantly from 2002 to 2006. Length of stay and mean inpatients costs increased with age. The overall in-patients 2006 costs was 79 millions with an average individual cost of 2100 € per hospitalized wrist fractures.
Conclusion: The incidence of hospitalizations for wrist fractures decreased in 2006 compared to 2002. The number of hospitalizations increased, as a consequence of ageing, (except for wrist fracture in men), with a subsequent increase in cost related to these fractures. The increase with age outlines the role of underlying osteoporosis and the relevance of appropriate care of patients at risk of for such fractures.
Level of evidence: IV.
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Introduction

Osteoporosis represents a major health problem, one of the musculoskeletal conditions included in The Bone and Joint Decade formally launched at the headquarters of the World Health Organization as of January 13, 2000 [1]. The aims of the campaign were to raise awareness of the
increasing societal impact of musculoskeletal injuries and disorders, to empower patients to participate in decisions about their care, to increase funding for prevention activities and research, and to promote cost-effective prevention and treatment. The large majority of osteoporotic fractures are non-hip non-vertebral fractures, and their consequences are more and more recognized. Their burden is characterized by an increase in risk of sustaining subsequent fractures [2–4], an increase of medical costs in the first year following the fracture [5] and an increase in mortality for some of them [6]. For every country, there is a need to evaluate the burden of osteoporotic fractures, to organize and plan action of prevention and the corresponding financing program [7]. The aim of our study was thus to describe the incidence and costs of one major non-hip non-vertebral fractures, i.e. wrist, and short-term outcomes, comparing years 2002 and 2006.

Methods

Data

We studied the burden of hospitalized wrist fractures in the French metropolitan population aged 30 years and older for two years, 2002 and 2006, respectively. Data were obtained from the French Hospital National Database which includes all hospitalizations occurring in public and private acute care setting in France. Wrist fractures were defined by their ICD-10 diagnosis codes: S52.5, S52.50, S52.6 and S52.60 encoded as primary diagnosis. The internal quality control of the data included three steps. Firstly, we selected only diagnosis-related group (DRG) associated with medical or surgical management of these fractures. Secondly, we excluded hospitalizations with mention of cancer as secondary diagnosis and hospitalization for polytrauma. Thirdly, we included only hospitalizations of patients living and managed in metropolitan France (i.e. overseas departments excluded). From 2002 to 2006, the rules of coding did not significantly change to impact the studied data and the decision of hospitalization was at the discretion of the physician. A one-day hospitalization was authorized if, in the context of our study, a loco regional or general anesthesia was performed.

Analysis

Data were stratified by gender and three age-classes (30–49, 50–69 and > 69 years). The data of the French census was used as reference for calculating adjusted incidence rates [8]. The effect of age was studied using the Chi-square test ($\alpha$=0.05). We used a test for trend in proportions to compare the percentage of hospitalizations in each age group for 2002 and 2006, respectively ($\alpha$=0.05) and Chi-square test ($\alpha$=0.05) for the incidence.

The 2002 length of stay was compared to year 2006 for each age group using an Anova (global $\alpha$=0.05). For 2006 only, we estimated and compared the in-patient costs for each age group, Anova, ($\alpha$=0.05).

Following data were described from 2006 hospital stays: type of hospital (private or public), type of management (medical versus surgical), type of admission and discharge, one-day hospitalization, and in-patient costs based upon the French National Tariff per DRG ($\epsilon$2008).

Data were processed using R statistical software (2.9.0 release, Copyright (C) 2009 The R Foundation for Statistical Computing, ISBN 3-900051-07-0).

Results

The French National Hospital Database comprised a total of 18.5 and 21.6 millions of hospitalizations in 2002 and 2006, respectively. The number of hospitalizations and incidence for wrist fractures adjusted by gender and age-class are presented on Table 1, Figs. 1(a) and 1(b). The admission for wrist fractures increased by 2% in women and decreased of 4% in men. A significant change of the number of hospitalizations was found in women for the first two age groups and in men only for the first age-group ($p<0.001$). The French metropolitan population aged over 29 years increased from 36,574,025 to 38,403,055, in 2002 and 2006, respectively. Table 2 describes the changes in the population according to age and gender. As expected, the number of women and men increased consistently in the last two classes.

The hospital incidence rates increased with age and year ($p<0.0001$, except in men). The incidence (for 1,000,000 inhabitants) whatever the gender changed from 2002 to 2006 from 1058 to 1015 (−%)$. This decrease was significant for both genders ($p<0.0001$). We found a most important decrease in the 30–49 class of age and over 69 years in women. In men, the decrease occurred in all age groups (Table 3).

Length of stay for each type of fracture is described on Table 4. In 2002 compared to 2006, the duration of hospitalizations decreased significantly. Several significant differences occurred according to age as shown on Table 4.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Hospitalizations and incidence for 106 inhabitants of wrist fractures adjusted for age and gender.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age-classesa</td>
<td>2002</td>
</tr>
<tr>
<td></td>
<td>Hospitalizations</td>
</tr>
<tr>
<td>Women/men</td>
<td></td>
</tr>
<tr>
<td>30–49</td>
<td>2981/3991</td>
</tr>
<tr>
<td>50–69</td>
<td>10,277/3095</td>
</tr>
<tr>
<td>&gt; 69 years</td>
<td>17,014/1352</td>
</tr>
<tr>
<td>&gt; 29 years</td>
<td>30,279/8348</td>
</tr>
</tbody>
</table>

a Statistical effect of age ($p<0.0001$).
The length of stay increased significantly with age whatever the year considered.

Fractures were mainly managed in public hospitals setting as shown on Table 5. In a majority of cases, fractures occurred at home. One-day hospitalization occurred for 10% of the hospitalizations. However, the percentage of one-day hospitalization for these fractures varied from 8 in 2002 to 9% in 2006 in women and from 10 to 12% in different age groups in men, respectively. For women, the percentages varied more consistently for the two years compared, with a decrease with age from 12 to 6% and from 16 to 7%, respectively.

In-patients costs are described in Table 6 for each age group. A significant increase of costs was found with age, adjusted on gender. For example, the cost increased by 128% and 24% from the age-class 30–49 years to >69 years for wrist fracture in women and men, respectively.

### Discussion

We studied the burden of wrist fractures, one major type of non-hip non-vertebral fracture. Our data showed a significant decrease in incidence of hospitalizations for wrist fractures from 2002 to 2006 in France, in both gender, since the numerator of the incidence rate (the number of hospitalizations) increased less than the denominator (the corresponding general population), despite the differential between gender change in admission rates (increase in women and decrease in men).

The data of the literature is seldom concerning the burden of wrist fractures at a country level. The increase in incidence with age for hospitalized wrist fractures in women...
Incidence and burden of hospitalized wrist fractures in France

was consistent with the literature [10–14]. In men, data on wrist fractures are contradictory: increase with age [10], continuous rise over the age of 65 [12], or no age effect as shown in our study [11,13–15].

These discrepancies can be explained by the source of data (all hospitals [our study, 11] versus one or few hospitals [10,12,15], selection of the type of fractures (important trauma, pathologic fracture in cancer [our study] versus all fractures [10,12]), length of the survey (one year [our study, 11] versus 2 years [10]), year of study (1998–9, [10], 1997–8, [12], 5-years data: 1995–1999 [14]), prospective study [15]. In United States, the most important incidence for wrist fractures occurred in women and men aged 50–64 years, and the incidence decreased for age superior to 64 years [16]. The difference may be explained by the fact that data were drawn from epidemiological studies.

In 2006, in France, hospital costs for hospitalized wrist fractures represented 535 millions $, the morbidity costs represented 1,157,196 $ (the most expensive costs compared to other studied fractures), the cheaper costs compared to other trauma. They are often incorrectly coded as fracture (ICD-10 codes beginning by ‘‘S’’) instead of fracture and/or osteoporosis. From the National Hospital Discharge Register, Vestergaard et al. [14] retrieved patients’ records where some were presenting with a diagnosis of osteoporosis (ICD-10: M80-M82) and others with a code of fracture (code beginning by ‘‘S’’). It appears thus that the true number of osteoporotic fractures may be even higher than described. To avoid a coding bias, some authors [17,19] applied to their data an estimate of osteoporotic probability proposed by a consensus of experts [21]. In our study, we excluded admissions where concomitant cancer or other traumas were encoded as secondary diagnoses. Our data were anonymous so we could not return to patients' medical records and specially X-rays [11,15,20], others looked at concomitant secondary codes like the mechanism of injury [10] or included only data from fracture related to low-energy trauma or falls and trauma [20]. The fractures associated with a moderate energy mechanism [10] repre-

Table 5  Characteristics of the 2006 hospitalizations for wrist fractures.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of hospitalizations</td>
<td>30,889</td>
<td>8090</td>
</tr>
<tr>
<td>% public</td>
<td>63</td>
<td>71</td>
</tr>
<tr>
<td>% surgical</td>
<td>89</td>
<td>89</td>
</tr>
<tr>
<td>Type of entry (%)</td>
<td>97</td>
<td>98</td>
</tr>
<tr>
<td>Type of discharge (%)</td>
<td>90</td>
<td>96</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Death</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>One-day hospitalization (%)</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>In-patients costs Millions 2008 €</td>
<td>66.9</td>
<td>12.2</td>
</tr>
</tbody>
</table>

Table 6  2006 hospitalizations for wrist fractures: average in-patients costs.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 29 years</td>
<td>2164 ± 1245$</td>
<td>2006 ± 1288$</td>
</tr>
<tr>
<td>30–49</td>
<td>1161 ± 894</td>
<td>1920 ± 1108</td>
</tr>
<tr>
<td>50–69</td>
<td>1812 ± 842</td>
<td>1936 ± 1342</td>
</tr>
<tr>
<td>&gt; 69 years</td>
<td>2470 ± 1419</td>
<td>2388 ± 1519</td>
</tr>
</tbody>
</table>

$ Anova: p < 0.0001

In another study where the sources of data were drawn from two randomized double-blind control trials, the costs associated with non-vertebral osteoporotic fractures in 5 European countries were estimated on the basis of local costs per DRG or average costs of hospitalizations per day in orthopedic wards [18]. The costs were expressed in 2002€. The range of in-patients costs for wrist fractures associated with or without surgery, varied among countries from 1321 to 3307€ and from 780 to 1960€, respectively. For the French data, the source for the cost estimates was from the 2001 DRG. The methods of classification per DRG changed in 2004 and more recently in 2009. Thus, even in a given country, comparisons must be analyzed and interpreted with caution.

In our study, admitted patients came from home in the majority of cases. Cuenca et al. [10] who analyzed most especially traumas and wrist fractures in women, showed the following distribution: home 34%, public road 49%, other 17% (in men, 24%, 52% and 24%, respectively). ICD-10 codes can be used to specify the place of trauma but this information useful for epidemiological studies are insufficiently coded in France (data not shown).

The burden of fractures varies considerably from countries to countries and the comparison is difficult due to different reasons. Few national data on wrist were published [9,14, and 17]. Some country extrapolated data from some hospital to all hospitals [19] or to the whole population [20]. In other papers, data were available from systematic radiological records reviewed for patients admitted to a single hospital [10], for different types of centers including hospital [11–12] and non-hospital data [11]; in another study data were drawn from a specific geographical area representative of age and gender distribution but isolated in terms of medical care [15], from questionnaires used to collect self-reported fractures in multicenter register in Europe [12], or from different epidemiological data [16]. The relevance of comparing data from such different databases is thus questionable.

Peripheral fractures related to osteoporosis occurred after minor or moderate trauma. They are often incorrectly coded as fracture (ICD-10 codes beginning by ‘‘S’’) instead of fracture and/or osteoporosis. From the National Hospital Discharge Register, Vestergaard et al. [14] retrieved patients’ records where some were presenting with a diagnosis of osteoporosis (ICD-10: M80-M82) and others with a code of fracture (code beginning by ‘‘S’’). It appears thus that the true number of osteoporotic fractures may be even higher than described. To avoid a coding bias, some authors [17,19] applied to their data an estimate of osteoporotic probability proposed by a consensus of experts [21]. In our study, we excluded admissions where concomitant cancer or other traumas were encoded as secondary diagnoses. Our data were anonymous so we could not return to patients’ medical records, but we postulated that the observed data corresponding to fractures were related to osteoporosis. In some papers, authors preferred to confirm their data with medical records and specially X-rays [11,15,20], others looked at concomitant secondary codes like the mechanism of injury [10] or included only data from fracture related to low-energy trauma or falls and trauma [20]. The fractures associated with a moderate energy mechanism [10] repre-
sented the most important burden of the studied fractures. This point outlined the need for an international consensus in the definition of the fractures related to osteoporosis [22].

Our study has some limitation. Firstly, hospitals data underestimate the real burden of wrist fractures. In France, out-patients’ data are not available, since these fractures do not lead systematically to hospitalization. Indeed, these fractures can be managed in emergency or by general practitioners or specialists in out-patient care. In some study, the database covered in- and out-patients [9,13]. Thus, these countries can really evaluate the burden of the studied fractures. Secondly, a patient can be hospitalized twice for a contra lateral fracture. Given the available data, we were unable to identify such occurrences. Since the length of our survey was one year, we considered that the occurrence of a contra lateral fracture was probably low and had no real impact on the calculation of incidence rates. Others considered one single event in repeated records of a given ICD code occurring in the same patient within 6 months [9].

Our study shows the increased burden of admissions for wrist fractures. Providing this type of information is important to aiding policy making and planning resource allocation.

Conflict of interest statement

No conflict of interest.

References