Original article

Incidence and characteristics of proximal femoral fractures in an Afro-Caribbean population

J.-L. Rouvillain a,*, F. De Cazes a, R. Banydeen b, K. Rome c, P. Numéric d, M. De Bandt d, C. Derancourt a

a Service de chirurgie orthopédique, CHU de Martinique, CS 90632, 97261 Fort-de-France, Martinique
b DRCl, CHU de Martinique, CS 90632, 97261 Fort-de-France, Martinique
c Service d’information médicale (DIM), CHU de Martinique, CS 90632, 97261 Fort-de-France, Martinique
d Service de rhumatologie, CHU de Martinique, CS 90632, 97261 Fort-de-France, Martinique

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A B S T R A C T

Background: Although fractures of the proximal femur (FPF) are supposedly less frequent in Black populations (studies of incidence are rare) the life expectancy in Africa is low, which could partially explain this notion. There is only one retrospective study on the incidence of FPF in the islands of the Caribbean, thus we performed an incidence study in the insular, circumscribed, 90% Afro-Caribbean population of Martinique. The goals of this study were: (1) to estimate the incidence of FPF; (2) and to prospectively describe the main characteristics.

Hypothesis: The incidence of fractures of the proximal femur in Martinique is lower than in Western countries.

Patients and methods: The raw and standardized incidence ratio of FPF in relation to the world population was estimated based on data from the Medical Information System Program (Programme de médicalisation des systèmes d’information [PMSI]) for all of Martinique for a period of 4 years (January 1, 2010 to December 31, 2013). Characteristics were based on all patients over the age of 60 who presented to the Fort-de-France University Hospital (CHU) for a FPF between December 1, 2011 and April 31, 2012. Patients with light-skin phenotype, high-energy fractures and secondary fractures were excluded from the study.

Results: The standardized incidence ratio in relation to the world population was estimated (n = 794) as 22.5/100,000 patient-years [20.6–24.4]: 22.6 and 22.4/100,000 in men and women respectively. The characteristics of eighty-seven patients (including 56 women), mean age 85.3 (±7.2) (62–100) years old were evaluated: 52 femoral neck fractures (60%) and 33 fractures of the greater trochanter (38%). The 2-month mortality rate was 21%, and 1/3 of the surviving patients could function independently. The risk of death increased in relation to the initial risk of moderate to severe dementia.

Discussion: The incidence of FPF in Martinique is lower than in Western countries including, as expected, an elderly, female population. Unlike a previous study performed in Guadeloupe, there was a majority of femoral neck fractures. A Caribbean multi-insular study is needed to confirm these results and to obtain precise data on bone density.

Level of evidence: IV; descriptive prospective epidemiological study.

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1. Introduction

There are 70,000 fractures of the proximal femur (FPF) in France per year with an estimated mortality rate of 30% at 1 year and significant consequences to functional autonomy [1]. However, the incidence of osteoporotic fractures is highly variable depending on geographic region and ethnicity. Several studies have shown a lower incidence of these fractures in Black, Hispanic and Asian populations [2,3].

The population in the Caribbean islands (41 million inhabitants) is mainly of Afro-Caribbean descent. The very recent general review on this topic by large geographic region did not report any specific data on the incidence of FPF in the Caribbean population [2], and the only study evaluating the incidence of FPF, which was retrospective and performed in Guadeloupe, was not included [4].

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Martinique, a French Overseas Department (département français d’Outre-Mer [DOM]), has 396,308 inhabitants (estimation INSEE 2010) [5] who are mainly of African descent. Martinique has a technological and operational platform allowing high-level surgical management. The distance from the French mainland (8000 km), and the circumscribed insular population, make this geographic region well fitted to study incidence.

The main goals of this study were to:

• estimate the incidence of FPF in the Caribbean island of Martinique;
• to provide a prospective description of the main characteristics.

Our hypothesis was that the incidence of FPF in Martinique was lower than in Western countries.

2. Materials and methods

2.1. Calculating incidence

A search was performed in the Medical Information System Program (Programme de médicalisation des systèmes d’information [PMSI]) of all healthcare facilities in Martinique for the 4-year period from January 1, 2010 to December 31, 2013. The search corresponded to the diagnosis of fractures: S720; S7200; S7201; S7210; S7211; S7220 and S7221, in the field “Medicine, surgery, obstetrics” only. We included patients who were over the age of 60 at diagnosis. The incidence was calculated for people over the age of 60 per 100,000 inhabitants, based on INSEE estimates for the period from 2010–2013 [5]. The incidence was standardized in relation to the world population [6].

2.2. Description of patient characteristics

After receiving approval for the research protocol from the regional ethics and scientific committee, all patients presenting to the Martinique University Hospital (CHU) with a FPF from December 1, 2011 to April 31, 2012 were prospectively included (except for those with exclusion criteria). Patients were included when they arrived in the emergency unit. High-energy traumas, secondary fractures, light-skinned phenotype (Caucasian) patients, and patients under the age of 60 were excluded.

2.3. Methods of assessment

The following information was noted: the type of fracture, the mechanism of trauma, the risk factors of osteoporosis, a Mini Mental Score (MMS) (a MMS ≤ 18 was the threshold for moderate dementia) [7], an evaluation of independence in activities of daily living based on the Katz score [8], the delay before surgery, the length of the hospital stay and the conditions of discharge. The results of 25-OH-vitamin D dosage were also obtained.

Data on outcome were obtained by telephone from each patient two months after hospitalization: return home, hospitalization, institutionalization, death, evaluation of independence on the Katz score and the results of bone mineral density (BMD) prescribed at discharge.

2.4. Statistical analyses

The characteristics of the population were expressed as means, medians and standard deviations for quantitative variables and for the study population and frequencies for qualitative variables. Comparisons of means between the two groups were performed by the Student t-test, the Kruskal-Wallis or the Mann-Whitney tests. Comparison of frequencies was performed by the Chi2 test or the Fischer exact test (depending on the type of distribution of the variables or the populations in the study groups). P<0.05 was considered to be significant corresponding to an alpha risk of 5%

All analyses were performed using SAS software (version 9.3) (SAS, Cary, NC, USA).

3. Results

3.1. Incidence

A total of 794 FPF were identified from January 1, 2010 to December 31, 2013 on the PMSI search: 716 fractures at the CHU of Fort-de-France and 78 elsewhere: clinic Saint-Paul (17), clinic Sainte-Marie (2) and the centre hospitalier de Trinité (59). The standardized incidence ratio of FPF fractures in Martinique in relation to the world population was 22.5/100,000 inhabitants/year [20.6–24.4]. In patients over 60, this incidence was 354.5/100,000 inhabitants/year [327.5–381.5]. The incidence by sex in men over 60 was 119.4/100,000 person-years [97.7–129.9] and 174.6/100,000 person-years for women [158.2–191.0]. Data according to age and sex are presented in Table 1.

3.2. Characteristics

From December 1, 2011 to April 31, 2012, 87 patients with a FPF presented at the CHU of Fort-de-France: 56 women and 31 men (sex-ratio = 1.8) mean age 85.3 years old ± 7.2 (range: 62–100). There were 52 femoral neck fractures (60%), 33 greater trochanter fractures (38%), 1 trochanteric-diaphyseal fracture (1%) and 1 subtrochanteric fracture (1%).

Only one patient was bedridden when the fracture occurred, 14 patients (17%) walked with help and 67 patients (81%) could walk on their own (Table 2).

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Table 1

<table>
<thead>
<tr>
<th>Age at diagnosis (years)</th>
<th>Standardized world incidence, per 100,000 (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
</tr>
<tr>
<td>Total population (all ages combined)</td>
<td>22.5 [20.6–24.4]</td>
</tr>
<tr>
<td>Total population (by age group) &lt;60</td>
<td>6.0 [4.6–7.4]</td>
</tr>
<tr>
<td>≥ 60</td>
<td>144.2 [132.7–155.7]</td>
</tr>
<tr>
<td>In patients 60 and over</td>
<td>52.9 [41.7–64.2]</td>
</tr>
<tr>
<td>70–79</td>
<td>126.3 [105.4–147.2]</td>
</tr>
<tr>
<td>80–84</td>
<td>321.8 [263.0–380.6]</td>
</tr>
<tr>
<td>85+</td>
<td>954.8 [851.7–1057.9]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population (all ages combined)</td>
<td>22.6 [19.6–25.7]</td>
</tr>
<tr>
<td>Total population (by age group) &lt;60</td>
<td>10.3 [7.6–12.9]</td>
</tr>
<tr>
<td>≥ 60</td>
<td>113.8 [97.7–129.9]</td>
</tr>
<tr>
<td>In patients 60 and over</td>
<td>47.4 [31.7–63.2]</td>
</tr>
<tr>
<td>70–79</td>
<td>107.6 [87.5–136.6]</td>
</tr>
<tr>
<td>80–84</td>
<td>221.9 [143.9–299.9]</td>
</tr>
<tr>
<td>85+</td>
<td>693.0 [542.3–843.7]</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population (all ages combined)</td>
<td>22.4 [20.3–24.5]</td>
</tr>
<tr>
<td>Total population (by age group) &lt;60</td>
<td>1.7 [0.8–2.6]</td>
</tr>
<tr>
<td>≥ 60</td>
<td>174.6 [158.2–191.0]</td>
</tr>
<tr>
<td>In patients 60 and over</td>
<td>58.4 [42.4–74.5]</td>
</tr>
<tr>
<td>70–79</td>
<td>144.9 [114.9–175.0]</td>
</tr>
<tr>
<td>80–84</td>
<td>421.7 [333.8–509.7]</td>
</tr>
<tr>
<td>85+</td>
<td>1216.6 [1075.8–1357.4]</td>
</tr>
</tbody>
</table>

Cl: confidence interval.
Table 2
Characteristics of 87 patients with a hip fracture between October 2011 and April 2012 in Martinique.

<table>
<thead>
<tr>
<th>Patient characteristics (n = 87)</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment course of patients with a history of osteoporotic fractures (n = 26 [30%])</td>
<td>10 treated patients: 6 patients with additional vitamin and calcium intake; 4 patients with bisphosphate intake</td>
</tr>
<tr>
<td>Average length of stay (days) (± SD; value intervals) (n = 82)</td>
<td>9.2 ± 3.4 (4–26)</td>
</tr>
<tr>
<td>Katz score (mean ± SD; median) (n = 82)</td>
<td>Before fracture: 4.9 ± 1.6; 6.0</td>
</tr>
<tr>
<td>Outcome after hospital discharge</td>
<td>At 2 months: 3.8 ± 2.0; 4.0</td>
</tr>
<tr>
<td>Death rate at 2 months (n = 69)</td>
<td>27 home-based (31%), 30 in follow-up care and rehabilitation units (34%), 21 hospital-based (24%), 9 unknown status</td>
</tr>
<tr>
<td>Living environment at 2 months (n = 37)</td>
<td>11 with dosage &gt; 30 mg/ml (30%)</td>
</tr>
<tr>
<td>Vitamine D dosage (n = 23)</td>
<td>11 with dosage &gt; 30 mg/ml (70%)</td>
</tr>
<tr>
<td>Osteodensimetry (n = 23)</td>
<td>Zero patient with normal results</td>
</tr>
<tr>
<td>Rho (25%): severe osteoporosis</td>
<td>12 (52%)</td>
</tr>
<tr>
<td>T ≤ 3</td>
<td>5 (22%) with osteoporosis</td>
</tr>
<tr>
<td>6 (26%) with osteopenia</td>
<td></td>
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<tr>
<td>SD: standard deviation; MMS: Mini Mental Score.</td>
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</tbody>
</table>

After two months, 18 patients (21%) had died, all causes of mortality combined.

There was no significant relationship between sex and the mortality rate (P = 0.7), or between the Katz score at admission and mortality (P = 0.3) (Table 2). On the other hand, the risk of death was higher in patients with a Mini Mental Score below the threshold of moderate dementia at admission (15 deaths) compared to other patients (0 death) (P = 0.007).

There was a significant loss of autonomy 2 months after the hip fracture FPF (P < 0.001), with a mean Katz score of 4.90 ± 1.57 at admission and 3.75 ± 1.95 at 2 months. At postoperative month 2, 15/69 (22%) surviving patients were bedridden, 26 (38%) could walk with help and 24 (approximately 1/3) were independent.

The mean hospital stay in the surgical unit was 9.2 ± 3.3 days (range: 4–26 days). The patients were transferred to either a rehabilitation center (n = 30), a peripheral hospital (n = 21) or home (n = 27). Two months after the fracture, 17 patients were still hospitalized (24.6% of the surviving patients).

Results of femoral bone mineral density (BMD) (n = 23) were: mean T = −2.89 ± 0.99, median T-score = −3.1, corresponding to 12 cases of severe osteoporosis, 5 cases of simple osteoporosis and 6 cases of osteopenia (Table 2).

4. Discussion

The results of this prospective study show that the incidence of FPF in Martinique appears to be much lower than in the United States or the European Union [1,2,9,10] because up to the age of 80 it was two- to five-fold less. This difference was especially found in comparisons performed in the United States where the incidence was 50% less in Black women over the age of 65 than in Caucasian women and 40% less in Black men than in Caucasian men [2]. Moreover, worldwide data show that the incidence can vary by as much as 140 in men and 200-fold in women depending on the geographic region in the world, not only due to ethnicity, but also to socioeconomic factors. The difference in incidence in our study compared to others seems to decrease in patients over the age of 85, especially in men. Perhaps the fracture threshold is reached later in this population.

It is important to note that in patients over the age of 85 the incidence in men and women is similar with a sex ratio close to 1, even if the absolute number of fractures in women is greater because there are fewer men in this age group. However our study population in this age group was too small to reach firm conclusions. In the same way, our PMSI results show that the incidence in men under the age of 65 is similar to that in women. It is difficult to compare our results to the only published study on the incidence of FPF in a Black African population (Cameroon, 2003) [11]. In that study the incidence was markedly lower than ours (0.41/10,000 woman-years and 0.22/10,000 man-years) because of the extremely low life expectancy in Cameroon (51). We did not take into account the results of the only other study from Africa, because it is extremely old (1968) and was performed in South Africa, which has widely diverse phenotypes (the Rainbow Nation) [12].

The methodology in our study and the circumscribed insular population limits the bias in our estimation of incidence. Moreover, this is a realistic series of patients: the mean age is older and similar to that in the study in Guadeloupe in 2006 [4], including mainly women, which is true in both «Caucasian» and «Black» populations [2,9–13]. Based on data from patients hospitalized over a 5-month period, we extrapolated the annual incidence ratio to be 25.3/100,000 inhabitants, which similar to the estimation obtained from PMSI data, even if it is slightly higher (monthly fluctuations).

The agreement of the results of this extrapolation with the number of PMSI cases suggests that the estimation based on PMSI is reliable.

The patients’ mean length of stay (MHS) in hospital was only 9.2 days, which was much lower than the mean national length of stay in France, which is 14 days. This result is coherent with a strategy to rapidly regain autonomy begun in 2007 in the orthopedic unit of the ChU in Martinique, with options for discharge from hospital planned with the family at admission and a close relationship with aftercare and rehabilitation centers as well as peripheral hospitals [14]. Only 4 patients (or 5% of this high risk population) were receiving anti-osteoporotic treatment when the fracture occurred and only 6 patients (8%) were receiving vitamin-calcium supplements.

The percentage of patients receiving treatment for osteoporosis was also low in a series of 41 patients hospitalized in a rehabilitation department on the French mainland in 2006 [15]. Thus, treatment of osteoporosis is as limited in Martinique as it is on the mainland in France, the Netherlands or the United States [15–18], despite the different action plans and information campaigns including the European Community action plan. Treatment for osteoporosis has been clearly shown to have value in primary prevention by reducing the risk of new vertebral and non-vertebral fractures as well as significantly reducing the mortality rate [19].

In our series of hospitalized patients, there were more true femoral neck fractures (60%), than greater trochanter fractures (38%), unlike the study in Guadeloupe with 55% of greater trochanter fractures [4]. Freedman and Register [20] have suggested that bone microarchitecture and vitamin D play a role in the lower risk of osteoporosis in Black and mixed races. The influence of ethnic factors on osteoporosis has been shown in several studies comparing populations of postmenopausal American Caucasian and Black women showing a significantly higher BMD and a lower prevalence of osteoporotic fractures in Black women after menopause. The same difference has been found between Caucasian and Asian American women [21,22].

Two-month mortality, all causes combined was 20.6% in our study, which is similar to European, American and Asian results with an overall mortality of 20% at 2 or 3 months [23,24]. We found a significant association between 2-month mortality and the presence of cognitive disorders (MMS score below 18). The lack of relationship between mortality and age or the degree of independence before the fracture in our study is probably due to the small size of the population.
5. Conclusion

The incidence of FPF is lower in a population of Afro-Caribbean descent in Martinique than in a Caucasian population, with a difference that seems to disappear in subjects over the age of 85. The specificities of FPF in Martinique with more femoral neck fractures than in the Guadeloupean study, and insufficient data on bone density, in probably specific to the French Antilles suggesting that a multicenter study of the islands of the Caribbean is needed to adapt screening programs and to develop actions for primary and secondary prevention [25].

Disclosure of interest

The authors declare that they have no competing interest.

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References