Non-simultaneous bilateral hip fracture: Epidemiologic study of 241 hip fractures

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Summary

Introduction: Hip fractures are an important public health problem given their growing incidence as well as their functional and vital repercussions. With longer survival, patients with a contralateral fracture are increasingly numerous. The objective of this study was to investigate the bilateralization of hip fractures in terms of anatomic location and time to the second fracture.

Hypothesis: Contralateral fractures are of the same anatomical type as the primary fractures.

Patients and methods: This was a retrospective epidemiological study on all patients managed for hip fractures between January 2007 and May 2008. Each case of bilateralization was studied.

Results: We included 241 patients in the study. The mean age at occurrence of the primary fracture was 83.3 years (range, 60—99 years). The distribution showed 45.6% true femoral neck fractures and 54.4% trochanteric fractures. Twenty-six of the 241 patients had already suffered from a hip fracture (10.8%). This fracture was the same type as the recent fracture in 80.8% of the cases. The mean time between the two fractures was 5.6 years (range, 1—277 months).

Discussion: The contralateral fractures were the same anatomical type as the primary fracture in eight out of ten patients and the symmetry remains intact in 64—83% depending on the series. The fracture occurred on average within 5 years of the first hip fracture. In cases of asymmetry, the second fracture was more often a trochanteric fracture. The causes explaining this symmetry are several and are poorly known. The risk factors are numerous and their prevention is essential (acting on the patient’s environment to prevent falls, rehabilitation to reestablish autonomy after the first fracture, and preventive treatment of osteoporosis), although these notions are often ignored by surgeons.

Level of evidence: IV, retrospective study.

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Introduction

Hip fractures, the leading fracture in the elderly, has an incidence of 80,000 new cases per year in France. This is a
worldwide problem related to the aging of the population, and its incidence is predicted to double if not triple in the coming 40 years [1—6]. Mortality is high: from 20 to 25% at 1 year [1—3,5,6]. The consequences are also considerable: functional and social repercussions, with loss of autonomy and quality of life in elderly patients, who generally suffer from comorbidities [2,5,7—9].

These fractures are classified into two types depending on their anatomic location: fractures through the trochanters (extracapsular fractures) and fractures of the femoral neck (intracapsular fractures). Surgical treatment differs depending on the anatomic location: femoral neck fractures are treated with osteosynthesis or arthroplasty depending on their type and the patient’s age. Trochanteric fractures are usually treated with reduction and osteosynthesis. The risk factors are multiple, but the probability of a hip fracture increases with age and different factors [4,7,10—12] such as female sex, osteoporosis, family history, and diet, as well as environmental and social factors.

The incidence of asynchronous bilateral hip fractures is 1.7—14.8% depending on the series [4,7,8,11—15]. Hip fractures alone are a major risk of contralateral fracture. With increasing age, there are more and more patients presenting two hip fractures, proving the relative inefficacy of prevention of the contralateral fracture. However, it seems that preventive measures are often ignored or not applied by the patients.

The objective of the present study was to analyze the bilateralization of hip fractures and attempt to respond to the following questions:

- Is the anatomic location of the two fractures identical?
- What is the time to the contralateral fracture?
- Can bilateralization be prevented?

Patients and methods

This was a single-center retrospective, continuous study on all patients managed for a hip fracture occurring between January 2007 and May 2008 in our orthopaedic and traumatology surgery unit.

We studied all the hip fractures treated in the emergency department during this period and noted the following criteria: patient age, type of fracture, type of surgical treatment, mortality, antiosteooporosis treatment, and institutionalization in a rehabilitation facility. In cases of contralateral fracture, we identified the fracture that had occurred earlier on the opposite side based on radiological data and the patient’s medical file and we noted the following criteria: type of fracture, age at onset, time between the two fractures, treatment provided, whether the patient was sent to rehabilitation, and whether preventive treatment was provided.

Pathological fractures other than osteoporotic, fractures caused by high-kinetic impact, and fractures with preexisting osteosynthesis material were excluded from the study, as were patients less than 60 years of age because their fractures could not be considered purely osteoporotic. One female patient presented a synchronous bilateral fracture and was excluded from the study.

Results

Overall series

We included 241 patients in the study: 186 females (77.2%) and 55 males (22.8%) with a mean age at the time of fracture of 83.3 years (range, 60—99 years). The fractures were femoral neck fractures in 110 cases (45.6%; mean age, 82.6 years) and trochanteric fractures in 131 cases (54.4%; mean age, 84.1 years). The fracture was on the right side in 132 cases (54.8%) and on the left in 109 cases (45.2%).

In 229 cases, treatment was surgical: 75 arthroplasties (70 total hip replacements and five cervicocephalic implants), 17 cervicocephalic screw fixations, three cervico-medullary nailing procedures, and 11 dynamic hip screws for the cervical hip fractures; 95 osteosynthesis fixations using cervico-medullary screws and 28 dynamic hip screws for trochanteric fractures. Twelve patients were not operated on because of a contraindication for anesthesia (four had a neck fracture and eight a trochanteric fracture). The majority of the patients were hospitalized in a rehabilitation and convalescence center after surgery (179 cases; 83.2%).

Twenty patients died during their hospitalization in the department (9.3%), nine after a femoral neck fracture and 11 after a trochanteric fracture. Nine patients (4.2%) were taking an antioestoporotic treatment (including three patients in the bilateral fracture group).

Contralateral fractures

Twenty-six patients among the 241 had already had a contralateral hip fracture (10.8%) (Table 1): 24 females and two males. This fracture was the same type as the recent fracture in 21 cases (80.8%). There were 11 patients (42.3%) with a femoral neck fracture who had already had a neck fracture on the other side (Fig. 1) and ten patients (38.5%) with a trochanteric fracture who had already had a neck fracture on the other side (Fig. 1) and ten patients (38.5%) with a trochanteric fracture who had already had...
Table 1  Asynchronous bilateral superior femur fracture: epidemiologic data.

<table>
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<tr>
<th>Case</th>
<th>Sex</th>
<th>First hip fracture</th>
<th>Second hip fracture</th>
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Discussion

In this study, the incidence of contralateral hip fractures was 10.8%, which is comparable to the data reported in the literature ranging from 1.7% to 14.8% [4,7,8,11—15]. The incidence is increasing as the population ages according to recent studies, in relation to the increase in osteoporosis [7,8,16]. Melton [3] describes an exponential increase of the incidence of hip fractures with age, par-

a trochanteric fracture on the other side. Four patients (15.4%) with a trochanteric fracture had already had a femoral neck fracture on the other side. A single cervical femoral neck fracture (3.8%) patient had been treated for a contralateral trochanteric fracture (Fig. 2). The mean age at the recent fracture onset was 86.4 years (range, 60—100 years). The mean time lapsed between the two fractures was 5.6 years (67 months; range, 1—277 months). Approximately 17% occurred in the first year after the first fracture and 33.3% in the 2 years following the first fracture. The patients’ mean age at the time of the first trochanteric fracture was 83 years (range, 64—94 years) and at the second fracture 90 years (range, 80—100 years). The mean age at the time of the first femoral neck fractures was 79 years (range, 70—96 years) and 81.8 years (range, 71—88 years) for the second fracture.

Figure 2  Non-simultaneous and assymetric bilateral hip fracture 13 months apart, treated with Gamma nail™ for trochanteric fracture on the left side and secondary screw fixation for Garden 1 cervical hip fracture on the right side, in a 77-year-old woman not receiving preventive drug therapy against osteoporosis.
allel to the increase in the risk of falling, also related to age.

Do these fractures occur at the same anatomic location?

The contralateral fracture was generally the same anatomic type as the first fracture, since we found 80.8% identical fractures, with a majority of bilateral femoral neck fractures (42.3%) compared to trochanteric fractures (38.5%).

Symmetry was respected in 64—83% of cases depending on the series [4,8,13,14]. Schroder et al. [13] found 6.2% contralateral fractures, with 68% the same anatomic type. Boston [14] had 83% identical fractures, 58% bilateral neck fractures, and 25% bilateral trochanteric fractures. One of the explanations advanced was the generalized decrease in the bone mass that was more pronounced in patients with a neck fracture [14], but this contradicts former studies that had found a more pronounced decrease in bone mass in patients with a trochanteric fracture [17,18].

Shabat et al. [4] (92% symmetry) explain symmetrization by the fact that each patient possesses his or her own gait and bone architecture, which could result in the same type of fall and therefore the same anatomic type of fracture. Fukushima et al. [8], Schroder et al. [13], and Ferris et al. [19] proposed morphological and endogenous criteria. The main morphological criterion could be the size of the femoral neck: a short neck—less than 5 cm—may favor the occurrence of a trochanteric fracture, whereas a long neck—longer than 5 cm—may preferentially result in a femoral neck fracture.

For the patients with two different fractures (19.2% in our study), these were for the most part trochanteric fractures after a contralateral neck fracture (80%). The same observation was made by Shabat et al. [4], who described seven patients with a trochanteric fracture after a contralateral neck fracture, whereas none of their patients had a neck fracture after a trochanteric fracture. Boston [14] noted 16.7% different fractures, eight out of nine of which were neck fractures followed by trochanteric fractures and only one out of nine was a trochanteric fracture followed by a neck fracture. One of the explanations could be the incidence of the type of fracture with age: it seems that trochanteric fractures occur in older patients than those with a neck fracture. The mean age of the patients with trochanteric fractures was 83 years in the entire series, whereas it was 79 years for neck fractures. As for contralateral fractures, the mean age was 90 years for trochanteric fractures versus 81.8 years for neck fractures. This trend toward a greater risk of trochanteric fracture with age has been confirmed in the literature [4,14,15,20,21].

What is the time lapsed to the second fracture?

The mean time lapsed between the two fractures was 67 months in this series (range, 1—277 months). Chapurlat et al. [11] found times ranging from 1 to 13 years, with a mean of 4 years. Berry et al. [7] described times ranging from 2 to 4 years. These times seem longer after a trochanteric fracture (a mean 60 months after a neck fracture versus 68 months after a trochanteric fracture). This difference may be explained by the time required to regain autonomy, which is usually longer after conservative treatment than after hip replacement.

Sex ratio

Our study confirms the clear predominance of hip fractures in females compared to males, with less than one-quarter male patients in the entire series. This proportion is also explained by the predominance of women at this age in relation to life expectancy.

Mortality and morbidity

Hip fractures are responsible for an increase in mortality (20—25% deaths at 1 year after the age of 70 years) and the acceleration of the loss of autonomy (leading cause of institutionalization) [1—3,5,6].

Tonetti et al. [21] showed that mortality after a hip fracture at 2.5 years was 41%, with 48% of deaths occurring in the first year. Thus, 92% of patients had satisfactory autonomy before the fracture versus 61.5% being independent and 52.6% autonomous for walking at 2.5 years. The fall causing the fracture was symptomatic of a pathological condition in 41% of cases. Zuckerman [9] evaluated postoperative autonomy after surgical treatment for a hip fracture at 20% no longer walking, 30% with altered autonomy, and only 30% returning to the previous level of autonomy.

The mortality rate found in our study was 7.7% in the patients who had a contralateral fracture versus 9.3% in the patients who had a single fracture. These results are difficult to interpret because our study has a short follow-up period and therefore shows short-term postoperative mortality. Boston [14] found higher mortality in the second fracture (30% at 3 months 13% after a first fracture). For Berry et al. [7], mortality increased from 16% at 1 year after a first fracture to 24% for a contralateral fracture. Haentjens et al. [22] found a higher mortality rate for trochanteric fractures (28% at 1 year versus 11% for neck fractures), which occur in older subjects whose return to autonomy may be more difficult because of the non-prosthetic treatment.

The predictive factors of death at the intermediate and long terms are advanced age (>85 years), history of a hip fracture, the patient having minimal autonomy before the fracture, and time to surgical treatment [18,21]. Limited autonomy is a risk factor for recurrence and a negative factor for survival [7,21].

Patient management should be complete and consist of treating the acute fracture episode and preventing onset of complications related to the patient factors and comorbidities while preserving the patient’s autonomy. This management should be multidisciplinary and both medical and surgical with surgeons, geriatricians, physical therapists, diéticians, and general practitioners [5].

Patient autonomy was not quantified preoperatively and postoperatively because the study was retrospective and precise functional data or a functional score (Parker score, etc.) was not available.
Preventing bilateralization

The risk factors for hip fracture are multiple [5,7,8,11,12,15]. Certain can benefit from preventive treatment (osteoporosis, iatrogenic factors, the decrease in physical activity, neurosensory and nutritional disorders), others have no effective preventive measures (maternal history of hip fracture, femoral neck length, hormonal antecedents) [6].

Osteoporosis, the leading risk factor for hip fracture, is undiagnosed and undertreated [4,6,12,16]. Yet a 5% increase in bone mineral density (BMD) seems to reduce the risk of fracture of the proximal extremity of the femur by 25% [6,23].

It has been demonstrated that medical treatments with bisphosphonates, estrogens, vitamin D and calcium, and more recently strontium ranelate [24], reduce the rate of hip fracture in elderly women [5,6,16,25–27]. Bisphosphonates increase BMD, in particular, during the first 3 years of treatment, and reduce the risk of nonvertebral fracture [16,23]. The indication is suggested after a vertebra, wrist, or hip fracture because these are signs of osteoporosis [5]. Since two-thirds of contralateral fractures occurred after 2 years in our study, it seems reasonable to believe that starting medical treatment for osteoporosis could reduce the rate of contralateral fractures.

Taking vitamin D in association with calcium reduces the incidence rate of hip fracture, particularly during the first 18 months [5,16,28]. This treatment preserves bone quality and reduces the risk of falls by improving muscle function [12,15]. Haetjens et al. [22] described the trochanteric fracture as often associated with vitamin D insufficiency.

Chapurlat and Meunier [16] confirmed the orthopaedic surgeon’s obligation to refer the patient for medical treatment of osteoporosis when they present with a typical fracture (fracture of the lower extremity of the wrist, vertebral fracture, or hip fracture). This management includes specific treatment for osteoporosis as well as calcium and vitamin D.

Shabat et al. [4] confirmed that preventive medical treatment is generally well accepted, whereas only 24% of patients receive it after a first fracture. Kamel et al. [29] demonstrated that only 5% of women are treated effectively after a first hip fracture. Examination of the study’s medical files showed the presence of preventive medical treatment for only nine cases (4.2%), three of whom were in the bilateral group (11.5%; 3/26).

Prevention of falls is vital [5,21]. The etiology found for falls shows minimal injuries for the second fracture compared to the first, such as a simple fall from a standing height or from a chair, occurring in the home, indicating that daily life activities have been reduced since the first fracture [4,8]. Added to this is the phenomenon of repeated falls for the second fracture. Merle [5] and Chiu et al. [30] observed that 80% of patients who had presented a hip fracture fell within the following year. Neurological deficits are major risk factors of falls in the elderly. Patients with bilateralization have a higher rate of dementia, neurological diseases, and Parkinson disease [4,8,30]. Denutrition is also a risk factor [6,21]. After a first hip fracture, efficacious rehabilitation must be set up with immobilization for as short a period as possible and exercises designed to increase walking and encourage rapid recuperation of autonomy. It is indispensable to adapt the patient’s environment or even equip the patient aiming to prevent future falls, as well as providing medical treatment adapted to his or her comorbidities.

Conclusion

Hip fractures are a public health problem for the elderly. The incidence of bilateral hip fractures is increasing with the aging of the population. Today, the frequency is around 10%, with 80% of the fractures identical to the first fracture. They occur on average within 5 years of the first hip fracture. Prevention is necessary and essential, requiring a triple action: on the patient’s environment, rehabilitation to reestablish autonomy after a first fracture, and preventive treatment for osteoporosis.

Conflict of interest statement

None.

References

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