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ORIGINAL ARTICLE

Secondary prevention of osteoporotic fractures: evaluation of the Lille University Hospital's Fracture Liaison Service between January 2016 and January 2018

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Abstract

Summary The purpose of this study was to assess the performance of our Fracture Liaison Service (FLS) over a period of 2 years. Osteoporosis medication was prescribed for 243 patients, and zoledronic acid was the main drug prescribed (60.2%).

Introduction A Fracture Liaison Service (FLS) was implemented at Lille University Hospital in 2016. The main purpose of this study was to assess the performance of the FLS using criteria proposed by the International Osteoporosis Foundation (*IOF*).

Methods The criteria used were patient identification, patient evaluation, post-fracture assessment timing, vertebral-fracture identification, blood and bone mineral density (BMD) testing, falls prevention, multifaceted health and lifestyle risk-factor assessment, and medication initiation and review.

Results Between January 2016 and January 2018, 736 patients (≥ 50 years old) with a recent history of fragility fracture (≤ 12 months) were identified. The identification rate for hip fractures was 74.2%. However, patient evaluation for all type of fractures was quite low (30.3%) since many patients failed to attend the FLS unit. The reasons for non-attendance were refusal, agreed but subsequently failed to attend, and still waiting to be seen. In all, 256 patients (76.6% female, mean (SD) age 74.3 (11.0) years) were seen at the FLS. Mean (SD) post-fracture assessment timing was 13.3 (9.3) weeks. Of the 139 patients seen for a non-vertebral fracture, 103 were assessed for vertebral fractures, and at least one new vertebral fracture was found in 45 of them (43.7%). Osteoporosis medication was prescribed for 243 (94.9%) patients. The main osteoporosis drug prescribed was zoledronic acid (60.2%).

Conclusions Secondary prevention of osteoporotic fractures has improved since the implementation of the FLS. However, patient identification, patient evaluation, and post-fracture assessment timing still need to be improved.

Keywords Fracture · Fracture liaison service · Hip fracture · Osteoporosis · Vertebral fracture

Introduction

Osteoporosis is defined as a skeletal disorder characterized by compromised bone strength (bone density and quality) predisposing to an increased risk of fracture [1]. It affects 30 to 40% of menopausal women, and 15 to 20% of men aged over 50 [2]. Over the past few years, the absolute number of osteoporotic hip fractures has increased in France, as highlighted in a study

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conducted by Briot K. et al. in 2015, which reported a 5% increase for women and a 22% increase for men between 2002 and 2013 [3]. Osteoporotic fractures are associated with a high risk of recurrent fracture, and it has been demonstrated that the occurrence of a fracture multiplies the risk of occurrence of a new fracture by 2 on average [4]. Osteoporotic fractures are also associated with increased morbidity and mortality and impaired quality of life [5]. For hip fractures, for example, the decrease in expected survival compared to the general population is about 20% in the year following the fracture [6]. In addition to their significant morbidity and mortality, osteoporotic fractures represent a significant cost to health insurance providers, with expenditures estimated at 4.8 billion euros for the year 2010 [7]. All of these factors combined—high risk of recurrent fracture after a first fracture event, high associated costs, and significant morbidity and mortality—emphasize the need for optimal secondary prevention of osteoporotic fractures.

Despite evidence of the effectiveness of osteoporosis medication [8–10] and despite the increase in the number of osteoporotic fractures, the prescription rate of these treatments has decreased in recent years, particularly in France [7]. In a report published in 2013, the French Health Insurance Authorities noted that osteoporosis medication was prescribed for only 15% of patients in the year following hospitalization for fracture [11]. In response to this deficit in secondary prevention care, Fracture Liaison Services (FLS) have been implemented in many countries around the world over the past 20 years. Typically, osteoporotic patients with fractures are identified by a nurse, who then schedules them for a bone densitometry scan, an assessment of bone status, and osteoporosis medication if necessary. The effectiveness of FLS units in the secondary prevention of osteoporotic fractures has been demonstrated through several studies. For example, Nakayama et al. [12] reported a 40% decrease in fracture rate for major re-fractures and a 30% decrease for all re-fractures in an FLS hospital compared with a similar non-FLS hospital [12]. Several studies have also reported a decrease in post-fracture mortality [13] and a decrease in costs [14] after FLS implementation.

It is against this backdrop that an FLS was implemented at Lille University Hospital in 2016 and a dedicated part-time clinical research assistant (CRA) hired. The main purpose of this study was to assess the performance of the FLS unit using criteria proposed by the International Osteoporosis Foundation (IOF) Capture the Fracture Best Framework tool [15].

Materials and methods

Fracture Liaison Service organization

We conducted a retrospective, single-center, observational study on all of the patients identified by the Lille University Hospital FLS during its first 2 years of existence (January 01, 2016 to January 31, 2018).

Inclusion criteria were adults of both genders, aged 50 or over, without dementia or impaired cognitive function, and admitted for a recent fragility fracture (≤ 12 months). Exclusion criteria were history of fragility fracture greater than 12 months, bone metastases or myeloma, fragility fractures due to primary hyperparathyroidism or chronic kidney disease, and periprosthetic fractures. Patients living too far away from Lille University Hospital were also excluded.

Figure 1 shows the FLS Pathway at Lille University Hospital.

In-patient pathway

In the Orthopaedic Department, patients were identified during weekly visits by the CRA (one visit per week). During the visits, patients were identified and received oral information on osteoporosis and its consequences, and asked if they agreed to be seen at the FLS unit. If they agreed, they were given a prescription for a blood test and a bone mineral densitometry (BMD) test, and an appointment was scheduled. In the Rheumatology Department, patients were identified, screened for secondary osteoporosis, and treated. A 6–12-month follow-up visit at the FLS unit was then scheduled.

Out-patient pathway

For the Emergency Department, we used a register held by the CRA to identify patients (one visit per week), who were then invited to be seen at the FLS unit. Moreover, many patients were also referred to the FLS unit by their general practitioner (Fig. 1).

For all patients seen at the FLS unit, the following data was collected: daily dietary calcium intake, laboratory workup (including creatinine, calcium, phosphorus, 25-OH vitamin D3, intact parathyroid hormone), and hip and lumbar spine BMD (measured by DXA with calculation of the FRAX® score) [16]. WHO criteria were used to define osteoporosis (T-score ≤ − 2.5) and osteopenia (T-score between − 1.0 and − 2.5) in post-menopausal women and in men ≥ 50 years old [17].

In line with the French guidelines on the management of postmenopausal osteoporosis [18], vertebral fracture assessment (VFA) and/or X-rays were performed when indicated. VFA is indicated in postmenopausal women with spinal pain or any of the following criteria: loss of height ≥ 4 cm compared to historical height (at 20 years of age), loss of height ≥ 2 cm as established prospectively during follow-up, previous vertebral fracture, chronic comorbidities, and treatments associated with a high risk of vertebral fracture (glucocorticoids and aromatase inhibitors).

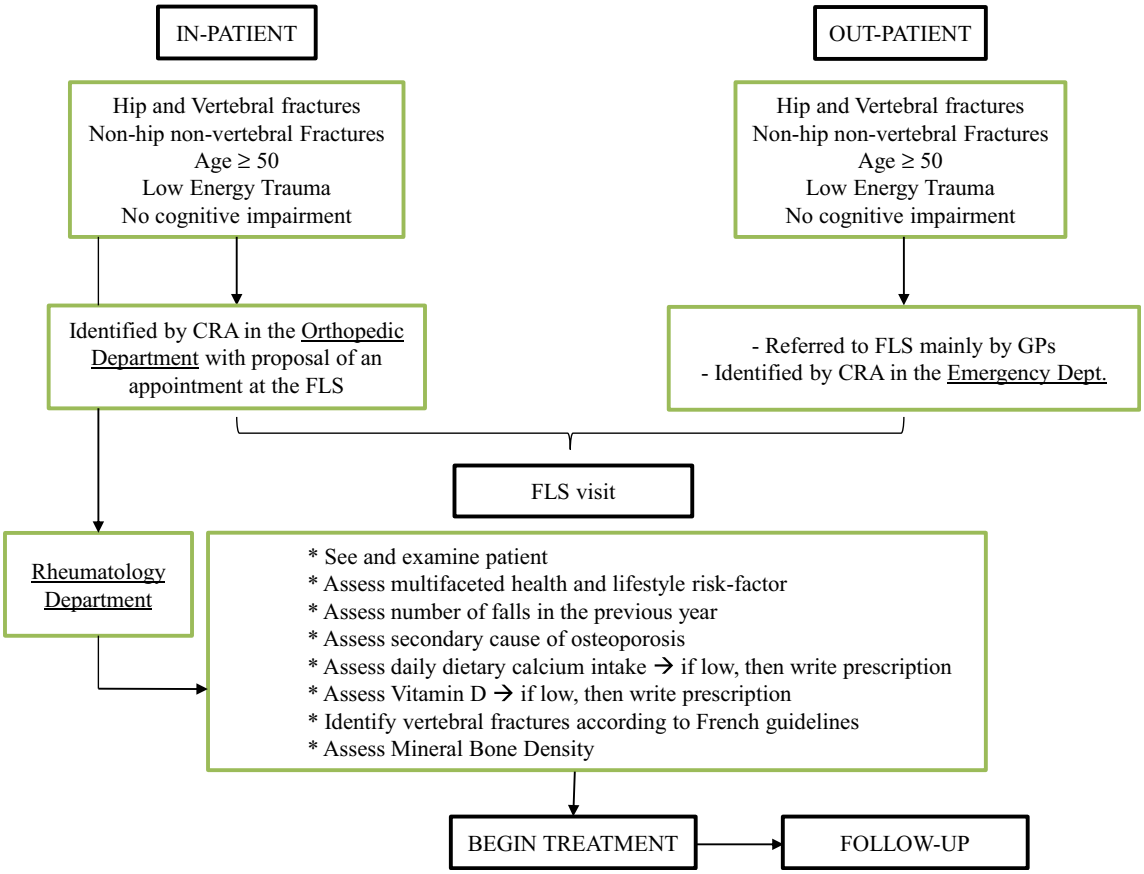

Fig. 1 Lille University Hospital FLS Pathway

Risk factors for osteoporosis were collected and included low body mass index (< 19 kg/m^2), current smoking, current alcohol abuse (≥ 3 units of alcohol per day for men, and ≥ 2 units for women), history of rheumatoid arthritis, use of oral corticosteroids (exposed to ≥ 5 mg/day of prednisolone for ≥ 3 months), previous low-trauma fracture, secondary osteoporosis, and family history of osteoporosis (hip fracture in mother or father). Data on prior use of menopausal hormone therapy were also collected.

Finally, we collected comorbidity data (using the Charlson Comorbidity Index (CCI) [19]) and medication data for all patients. We also analyzed what kind of osteoporosis medications had been formerly prescribed for each patient.

Patients

Between January 2016 and January 2018, 604 of the 736 patients identified by the FLS were eligible for inclusion and 132 patients (22.7%) were excluded due to dementia, severe cognitive disorders, or living too far away from the Lille University Hospital. Of the 736 patients, 582 came from the Orthopaedic Department, 76 from the Rheumatology Department, 17 from the Geriatric Department, 1 from the Emergency Department, and 78 were identified directly during external medical visits (referred to FLS mainly by GPs). Of the 604 eligible patients, 333 (55.1%) failed to attend the FLS unit for the following reasons: refusal or agreed but subsequently failed to attend ($n = 175$, 29.0%), and still waiting to be seen ($n = 158$, 26.2%) (Fig. 2).

Study procedure

Data was collected in a database which was populated in real time whenever a patient was seen at the FLS. The patients' characteristics were then analyzed. To evaluate the quality of our FLS, we performed a descriptive analysis of the cohort of identified patients using the following 13 criteria proposed by the IOF in 2013 [15]: (1) patient identification, (2) patient evaluation, (3) post-fracture assessment timing, (4) vertebral fracture identification, (5) assessment guidelines, (6) blood and BMD testing, (7) falls prevention, (8) multifaceted health and lifestyle risk-factor assessment, (9) medication initiation, (10) medication review, (11) communication strategy, (12) long-term management, and (13) database.

To assess identification and evaluation of patients with a history of recent fragility fracture (IOF Standard 1 and 2), we only evaluated hip fractures in the in-patient orthopedic unit over the last 15 months of our study period (November 2016

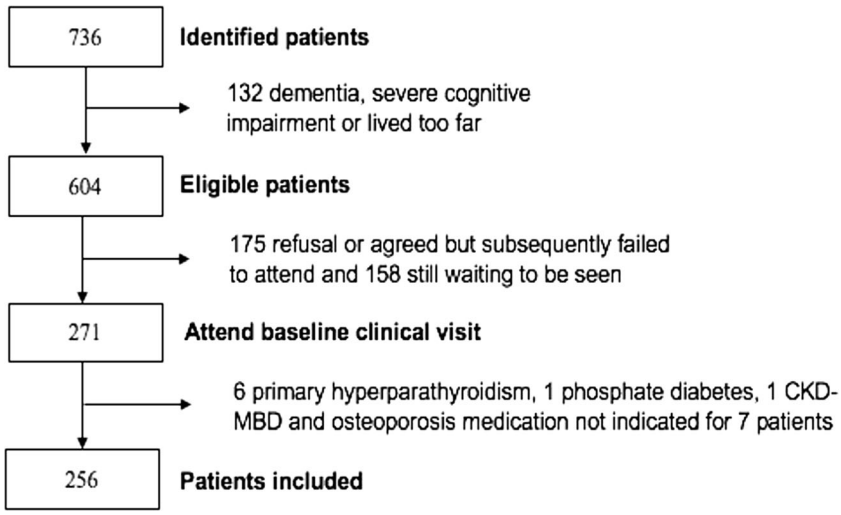

Fig. 2 Study population flow chart

to January 2018). We chose to evaluate only hip fractures rather than all fractures because it was easier to identify all patients with hip fractures using *PMSI* (French Information System Medicalisation Program) codes (further information and material available on request). We chose to assess hip fractures over the last 15 months because the CRA's weekly visits were not regular during the first 9 months of operation of the FLS and there were several weeks for which no data were collected. For the rest of our analyses (from IOF Standard 3 to 13), we assessed all type of fractures (hip and non-hip fractures).

Using the collected data, we were also able to determine the proportion of patients identified for a non-vertebral fracture who had been assessed for vertebral fractures. In that group of patients, we were able to identify those who actually had one or more unknown vertebral fracture(s).

For falls risk, we determined the proportion of patients reporting at least two falls in the year preceding the fracture. We then determined the proportion of those patients receiving a specific geriatric evaluation with management of falls.

Statistical analysis

Statistical analyses were performed using SAS software (version 9.4, SAS Institute). Descriptive statistics used for quantitative parameters were mean, standard deviation, and minimum, maximum and median values. For qualitative parameters, frequency and percentage were used. A $p < 0.05$ was considered to be statistically significant.

Results

Table 1 shows in detail the evaluation of the Lille University Hospital FLS using IOF criteria. The Lille University Hospital FLS was evaluated by the Capture the Fracture® committee and was awarded a Bronze (68%) rating.

IOF Standard 1: patient identification

Between November 2016 and January 2018, 326 patients ≥ 50 years of age with a low-trauma hip fracture were hospitalized in the in-patient orthopedic unit. Of these 326 patients, 242 (74.2%) were identified by the FLS.

IOF Standard 2: patient evaluation

Of the 242 patients identified in the Orthopaedic Department for a recent hip fracture, 112 patients were eligible for inclusion in the study and 130 patients were excluded for one of the following reasons: absent during the visit ($n = 16$), severe cognitive disorders ($n = 80$), and death ($n = 34$). A total of 34 patients were seen at an initial medical visit, and 78 patients failed to attend the FLS unit for one of the following reasons: refusal ($n = 54$), still waiting to be seen ($n = 10$), and agreed but subsequently failed to attend ($n = 14$). For hip fractures, patient evaluation was quite low (30.3%, 34/112 patients).

IOF Standard 3: post-fracture assessment timing

Between January 2016 and January 2018, a total of 271 patients were referred to our FLS unit for a medical visit after sustaining a fragility fracture. Mean (SD) post-fracture assessment timing was 13.3 (9.3) weeks.

Of the 271 patients referred to our FLS unit, 15 were excluded from analysis after medical assessment, DMO, and laboratory workup: six of the patients had primary hyperparathyroidism, one had idiopathic phosphate diabetes, one had chronic kidney disease-mineral and bone disorder (CKD-MBD), and osteoporosis medication was

Table 1 Evaluation of the Lille University Hospital FLS unit using IOF criteria

IOF Standards		Lille University Hospital Level
Standard 1		
Patient identification (only performed for hip fracture)	74.3% (242/326)	No data
Standard 2		
Patient evaluation among eligible patients (hip fracture)	30.3% (34/112)	No data
Standard 3		
Post-fracture assessment timing (mean, SD)	13.3 (9.3) weeks	Silver
Standard 4		
Vertebral fracture (patients with nonvertebral fractures)	Routinely undergo assessment with VFA	Bronze
Standard 5		
Assessment guidelines	The institution's assessment is consistent with national guidelines	Gold
Standard 6		
Secondary causes of osteoporosis	94.9% of patients screened (243/256)	Gold
Standard 7		
Falls prevention services	69.7% (23/33)	Gold
Standard 8		
Multifaceted health and lifestyle risk-factor assessment	> 90% of inpatients undergo multifaceted risk-factor assessments	Gold
Standard 9		
Medication initiation	94.9% (243/256)	Gold
Standard 10		
Medication review	> 90% Patients on treatment at the time of fracture were assessed for medication compliance with consideration of alternative interventions if necessary	Gold
Standard 11		
Communication strategy		Silver
Standard 12		
Long-term management	Follow-up 6–12 months after the first FLS medical consultation.	Bronze
Standard 13		
Database	Fragility fracture patient records are recorded at Lille University Hospital's database	Bronze

not indicated in seven patients in line with French guidelines on the management of postmenopausal osteoporosis [18]. A total of 256 patients (76.6% female, mean (SD) age 74.3 (11.0) years) were included. Mean (SD) BMI was 25.5 (± 5.1) kg/m^2. Regarding recent history of fragility fracture (≤ 12 months), some patients had several fractures, and 289 fractures were found in 256 patients. There were 117 patients with at least one X-ray diagnosed vertebral fracture (45.7%), 45 hip fractures (17.6%), 27 proximal humerus fractures (10.6%), 21 pelvis fractures (8.2%), and 17 distal forearm or wrist fractures (6.6%) (Fig. 3). There were 203 major osteoporotic fractures (79.3%) as assessed using the FRAX tool and 219 major fractures (85.6%) (hip, vertebra, distal femur, proximal humerus, pelvis, proximal tibia) according to Bliuc et al [20].

IOF Standard 4: vertebral fracture identification

Of the 139 patients seen for non-vertebral fractures, 103 patients (74.1%) had undergone a morphological assessment of the spine. An unknown vertebral fracture was diagnosed in 45/103 patients (43.7%).

IOF Standard 5: assessment guidelines

The Lille University Hospital FLS unit's assessment is consistent with French guidelines [18].

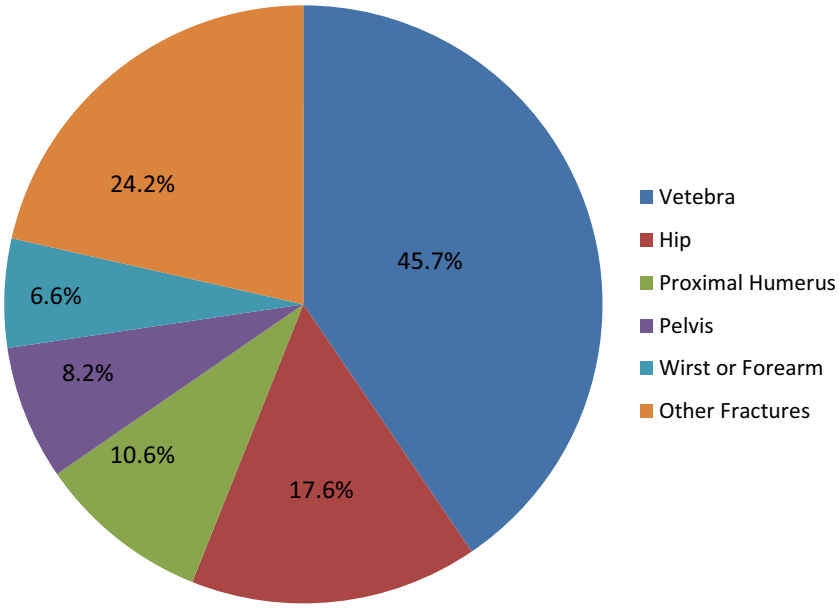

Fig. 3 Repartition of the 289 fractures in the 256 patients analyzed

IOF Standard 6: secondary causes of osteoporosis

Rate of blood testing was 94.9% (243/256). Level of 25-OH vitamin D was available in 218 patients (85.2%), with 25 patients (11.0%) < 10 ng/ml and 85 patients (37.4%) > 30 ng/ml. Creatinine clearance was available in 240 patients (93.8%) and < 60 ml/min in only 37 patients (15.4%).

Rate of BMD testing was 83.6% (214/256). Of these, 88 patients (41.1%) had osteoporosis. Regarding demographic data and relevant baseline characteristics, no statistical differences were observed between patients with BMD testing (n = 214) and those without BMD testing (n = 42), except for age. Indeed, patients with BMD testing were younger than those without (mean age: 73.5 ± 10.9 years vs. 77.9 ± 10.9 years; p = 0.02). Median (Q1-Q3) FRAX® scores among patients who had BMD testing were 12.0% (7.6–21%) for major fractures and 4.2% (1.7–9.0%) for hip fractures.

IOF Standard 7: falls prevention

Of the 256 patients analyzed, 33 patients (12.9%) reported having had at least two falls in the previous year, and 23 of them (69.7%) were referred to a geriatrician-led evidence-based Falls Prevention Clinic.

IOF Standard 8: multifaceted health and lifestyle risk factor assessment

Of the 256 patients, 11 (4.3%) had a BMI < 18.5 kg/m^2, and a history of osteoporotic fracture was found in 123 patients (48.2%) (Table 2). There were 31 patients with premature menopause (below the age of 45) (18.3%), 21 patients with a family history of first-degree hip fracture (8.3%), 26 with prolonged corticosteroid exposure (10.3%), 20 patients were active smokers (7.9%), and 14 had excessive alcohol consumption (5.5%).

For comorbidities, we found 52 patients with a history of or current cardiac arrhythmia (20.5%), 45 with diabetes mellitus (17.7%), 40 with a history of any cancer (15.7%), 23 with prior stroke (10.2%), and 20 with a history of ischemic heart disease (7.8%) (Table 3). Median Charlson (CCI) score was 4.0 (range 3.0–5.0).

Regarding medications, 39 patients were on diuretics (15.2%), 36 on benzodiazepines (14.3%), and 27 on anti-arrhythmic drugs (10.7%) (Table 3).

IOF Standard 9: medication initiation

Osteoporosis medication was prescribed in 243/256 patients (94.9%) in line with French guidelines [18]. Thirteen (5.1%) refused medication. The main osteoporosis drug prescribed was zoledronic acid (60.2%), followed by teriparatide (16%) and denosumab (13.7%). Oral bisphosphonates were prescribed for a few patients (5.3%).

IOF Standard 10: medication review

Prior osteoporosis medication was found in 52 patients (20.6%) (Table 2). A review of medication compliance and/or consideration of alternative interventions were performed for more than 90% of these patients.

IOF Standard 11: communication strategy

For each patient, an FLS management plan was communicated to primary and secondary physicians in the form of a letter containing information on primary osteoporosis risk factors,

Table 2 Demographic data and relevant baseline characteristics of the 256 patients included

	All patients ($n = 256$)
Female gender, *n* (%)	196 (76.6%)
Age, years (mean ± SD)	74.3 ± 11.0
Body mass index (kg/m^2) (mean ± SD)	25.5 ± 5.1
BMI < 18.5 kg/m^2, *n* (%)	11 (4.3%)
18.5 ≤ BMI < 25 kg/m^2, *n* (%)	126 (49.2%)
25 ≤ BMI < 30 kg/m^2, *n* (%)	76 (29.7%)
BMI ≥ 30 kg/m^2, *n* (%)	43 (16.8%)
Osteoporosis risk factors	
Smoking, *n* (%)	20 (7.9%)
Alcohol abuse, *n* (%)	14 (5.5%)
Premature menopause, *n* (%)	31 (18.3%)
Family history of hip fracture, *n* (%)	21 (8.3%)
Corticosteroids exposure, *n* (%)	26 (10.3%)
Previous fragility fracture, *n* (%)	123 (48.2%)
- Vertebra, *n* (%)	58 (22.8%)
- Wrist, *n* (%)	37 (14.6%)
- Shoulder, *n* (%)	21 (8.3%)
- Hip, *n* (%)	18 (7.1%)
- Leg, *n* (%)	6 (2.4%)
- Ankle, *n* (%)	5 (2.0%)
- Pelvis, *n* (%)	2 (0.8%)
Prior osteoporosis medications, *n* (%)	52 (20.6%)
Oral bisphosphonate, *n* (%)	40 (15.8%)
Zoledronic acid, *n* (%)	10 (4.0%)
Teriparatide, *n* (%)	8 (3.2%)
Denosumab, *n* (%)	1 (0.4%)
Prior menopausal hormone therapy, *n* (%)	35 (20.8%)
BMD testing*, *n* (%)	
- Osteoporosis	88 (41.1%)
- Osteopenia	105 (49.1%)
- Normal	21 (9.8%)

*$n = 214$

BMD testing, assessment of vertebral fractures, fracture risk factors, lifestyle risk factor assessment, current drug treatment, and a follow-up plan for the patient.

IOF Standard 12: long-term management

Each patient was scheduled for follow-up 6–12 months after the first FLS visit. Further analyses are ongoing regarding osteoporosis treatment adherence and refracture rate at 12 months.

IOF Standard 13: database

Data on the Lille University Hospital Fracture Liaison Service were recorded in a local database.

Table 3 Comorbidities and medication use in the 256 patients analyzed

	All patients ($n = 256$)
Comorbidities	
Arrhythmia, *n* (%)	52 (20.5%)
Diabetes mellitus, *n* (%)	45 (17.7%)
Depression, *n* (%)	26 (10.2%)
Stroke, *n* (%)	23 (9.0%)
Ischemic heart disease, *n* (%)	20 (7.8%)
COPD *n* (%)	16 (6.3%)
Chronic heart failure, *n* (%)	16 (6.3%)
Epilepsy, *n* (%)	12 (4.7%)
Peripheral arterial disease, *n* (%)	12 (4.7%)
Parkinson's disease, *n* (%)	9 (3.5%)
Rheumatoid arthritis, *n* (%)	6 (2.4%)
Liver cirrhosis, *n* (%)	5 (2.0%)
Medication	
Diuretics, *n* (%)	39 (15.2%)
Benzodiazepines, *n* (%)	36 (14.3%)
Anti-arrhythmics, *n* (%)	27 (10.7%)
Glucocorticoids (oral), *n* (%)	26 (10.3%)
Anticonvulsants, *n* (%)	23 (9.1%)
Glucocorticoids (inhaled), *n* (%)	22 (8.7%)
Hypnotics and sedatives, *n* (%)	21 (8.3%)
Anti-Parkinson medication, *n* (%)	9 (3.5%)

Discussion

Main findings

Secondary prevention of osteoporotic fractures is a major public health issue because of its economic repercussions and its impact on morbidity and mortality [6, 7]. Many FLS units have been implemented globally to identify and treat patients with a recent osteoporotic fracture. It is in this context that an FLS unit was implemented at Lille University Hospital on January 1st, 2016. This study evaluated the efficacy of secondary prevention in the Lille University Hospital FLS over a 2-year period using IOF criteria. Between January 2016 and December 2018, 271 patients with a fragility fracture were evaluated. Almost all patients underwent BMD by DXA and blood testing. Osteoporosis risk factors and comorbidities were assessed in more than 90% of them. Of the 139 patients seen for a non-vertebral fracture, 103 were assessed for vertebral fractures and at least one new vertebral fracture was found in 43.7% of them. Osteoporosis treatment (mainly zoledronic acid) was prescribed in 94.9% of these patients.

Comparison with other studies

Regarding the completeness of hip fracture identification, an identification rate of 74.2% was found. Compared to data from the literature, this figure seems satisfactory. Indeed, in a 2017 audit by the Royal College of Physicians in the UK, analyzing the data from 50 English FLS units in 2016, the average identification rate was 40%, and only 12% of the FLS units had an identification rate of more than 80% [21]. In our study, only 25.8% of patients with hip fracture were not identified by the FLS. This figure is partly explained by the fact that the in-patient orthopedic department had not been visited by the FLS's CRA for 4 weeks. An analysis of unidentified patients' data also revealed that several patients had been hospitalized for only a few days, making them difficult to identify with only one weekly visit.

The in-unit evaluation rate among eligible identified patients was 30.3%. This result can be explained, in part, by the significant number of patient refusals (37.0%). In a 2015 publication by Javaid K et al. [22], analyzing self-assessment of 60 FLS units worldwide using the 13 IOF criteria, 16% of the FLS units reported evaluating less than 50% of patients identified for hip fracture, and 64% of them had an evaluation rate of more than 90%. The differences between the evaluation rates reported in that study and our evaluation rate are mainly explained by the fact that our FLS only sees patients who agree to be seen, whereas in most FLS units, patients are seen systematically once identified. In a study conducted by Dehamchia-Rehailia et al. [23], analyzing the Amiens University Hospital FLS, which also requires patients' agreement, the authors reported a refusal rate similar to ours, with 45.4% of eligible patients refusing treatment. In an effort to reduce the number of refusals, we are now discussing with the Orthopaedic Department the possibility of having general practitioners systematically include in their hospitalization letters the fact that bone evaluation with BMD testing and bone biological exploration is needed, and that osteoporotic treatment must be discussed in accordance with French guidelines on the treatment of osteoporosis. Our low evaluation rate can also be explained by the significant number of patients still waiting to be seen at our FLS (35.1%). This backlog is due to the fact that our FLS currently only receives patients for evaluation 3 times a month, which is not enough to cope with the demand.

Average post-fracture assessment timing was 13.3 weeks among the 117 patients from the in-patient Orthopaedic Department, but 58.2% patients were seen within 3 months. The proportion of patients evaluated within 3 months averaged 67% in the Royal College of Physicians study on 50 FLS units [21], which is consistent with our results.

We performed vertebral fracture screening in 74.1% of patients with non-vertebral fractures. A diagnosis of unknown vertebral fracture was made in 32.4% patients. Our good vertebral-fracture diagnosis rate underlines the interest of systematically including this procedure for FLS patients.

A total of 12.9% of patients were assessed at high risk of falling, with at least two falls in the previous year. This figure seems quite low compared to data from the literature, where the risk of falling after 65 years is usually around 33% [24]. The difference may be explained by our evaluation of the risk of falling, which was summarized as history of falls without any clinical tests, such as the unipodal stance test or the timed up and go test.

The main types of fractures found were vertebral fractures (54.7%), hip fractures (17.6%), and proximal humerus fractures (10.6%). The predominance of vertebral fractures is probably explained by the fact that many of the patients were recruited from the Department of Rheumatology. A total of 123 patients (48.2%) had a personal history of osteoporotic fracture. This finding is supported by the study conducted by Edwards BJ et al. [25], which found in 632 patients hospitalized for a hip fracture, a history of fragility fracture in 45% of cases.

Regarding biological data, the average level of 25-OH-Vitamin D observed was ≥ 20 ng/ml in 72.2% of patients. This rather satisfactory rate was explained by the existence of prior vitamin D supplementation in the majority of patients. Our results are consistent with the findings of Amouzougan et al. [26] which demonstrate that screening for and managing vitamin D deficiencies is common practice among GPs.

Osteoporosis medication was prescribed in 243 patients (94.9%) although only 88 patients had osteoporosis. According to the evidence-based French guidelines for postmenopausal osteoporosis [18], recommendations place strong emphasis on the treatment of women with major fractures, defined by Bliuc et al. [20], in whom the use of osteoporosis medications is recommended. There were 219 major fractures (85.6%) (hip, vertebra, distal femur, proximal humerus, pelvis, proximal tibia) and all those fractured patients were eligible for medication initiation.

Strengths and limitations

One of the strengths of our study is the low level of missing data thanks to standardized and systematic collection of patient information during the dedicated medical visit. Another strength of our study is that we used standardized criteria to evaluate our FLS. This allowed us to choose quantifiable evaluation parameters so that our results could be compared with data from the literature.

One of the limitations of our study is that the completeness of identification for vertebral fractures was not assessed. However, vertebral fractures were not systematically assessed in line with French guidelines on the management of postmenopausal osteoporosis [18]. Our population of fracture patients was also skewed by low recruitment of Emergency Department patients, who generally present with a different fracture pattern and a predominance of minor fractures. This

explains why the vast majority of fractures were major osteoporotic fractures. We also did not include patients with dementia or severe cognitive impairment, who have a high risk of falling and therefore a high risk of fracture.

Plan to improve our FLS

The identification system at the Lille University Hospital FLS seems functional and efficient. However, it could probably be improved by scheduling a second weekly visit to the Orthopaedic Department to identify as many patients as possible, including those leaving after a short stay. The Emergency Department pathway could also be developed in the coming years to better identify and manage fracture patients treated as outpatients. Systematic screening of patients hospitalized in both the Orthopaedic and Emergency Departments could also be introduced in the coming years.

Regarding patients with severe cognitive impairment or dementia, the hiring of a geriatrician dedicated to the Traumatology Department could also be considered. We also need to improve our falls risk evaluation in collaboration with the geriatrician-led evidence-based Falls Prevention Clinic.

Conclusions

Our study demonstrates the effectiveness of the Lille University Hospital's FLS unit in identifying patients hospitalized for a recent hip fracture. It also demonstrates good management of fracture patients after FLS evaluation and a good vertebral fracture screening rate.

However, post-identification information to patients and patient adherence need to be improved to increase the patient evaluation rate, which remains low. We also need to develop the action of our FLS unit among Emergency Department patients, many of whom are currently not seen by our unit. Finally, we need to improve the ease of access to the FLS medical visit since too many patients are being identified but not evaluated.

Although some operational aspects of our FLS unit still need to be improved, the initial results are encouraging. In the coming years, we will have to deal with an ever increasing number of osteoporotic fractures due to the aging of the French population. We must therefore pursue the development of the FLS and improve its organizational structure and operation, as it is an effective tool in the secondary prevention of osteoporotic fractures.

Compliance with ethical standards

Conflicts of interest Julien Paccou has received honoraria from Amgen, MSD, Eli Lilly and Pfizer. Bernard Cortet has received honoraria from Amgen, Eli Lilly, Expanscience, Ferring, Medtronic, Novartis, and Roche Diagnostics. For the remaining authors, none were declared.

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