What predicts initiation of osteoporosis treatment after fractures: education organisation or patients' characteristics?

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ABSTRACT

Objectives. *Fracture events due to Osteoporosis (OP) are a major health burden in an ageing population. Their diagnosis and treatment provides the opportunity to prevent further fractures. However, the identification and treatment of underlying OP is often unsatisfactory. This longitudinal observational study, attempts to understand the barriers hindering OP treatment initiation in patients entering our hospital for fragility fracture.*

Methods. *349 patients with fragility fracture underwent OP education (interview with a trained nurse) and were offered further OP care either with their general physician (or private rheumatologist) or at the hospital. In the latter case, the patients were given an appointment for OP-centred investigation and consultation. Six months after the fracture they were contacted to know whether they had been investigated and had started a treatment for OP (outcome). The factors predicting the outcome were analysed.*

Results. *The organisation of further OP care at the hospital yielded the highest probability of being treated (OR 118.09; 95%CI [13.93-1000.92]), while patient's education on OP had a slighter effect (OR 4.74; 95%CI [2.15-10.44]). A low social status was the strongest patient-related negative predictor of further treatment (OR 0.22 [95%CI 0.09-0.47]).*

Conclusion. *The organisation of patients' OP care is the strongest determinant of OP investigation and treatment after fracture, and this aspect should be considered when attempting to increase OP care in everyday practice. Patients having a low social status are less likely to be investigated and treated, and additional efforts to properly organise their care are warranted.*

Introduction

The treatment of fragility fractures (FF) provides the opportunity to prevent further FF, whose risk is 1.5- to 9.5-fold increased after the first fracture event (1). However, the initiation of a preventive osteoporosis (OP) treatment in these high risk patients is often lacking (2). Liaison systems between orthopaedic and medical departments are developed in order to initiate a program for OP education, investigation and treatment (3, 4) but with finally poor results.

To better understand the barriers hindering further OP care after fracture, we studied a population of patients admitted at the hospital for FF that underwent a dedicated education on OP and a proposition of subsequent OP-care. We then analysed the factors that predicted OP treatment and investigation status in the 6 months after the fracture event.

Patients and methods

Three hundred and forty-nine consecutive patients (age >50y) admitted to the emergency (outpatients) or orthopaedic units (inpatients) for FF were included. FF was defined as a fracture occurring after a fall from standing height or less, excluding cervical, facial or fingers fractures. Patients' demographics were analysed including age, gender, social status. Patients having at least one of the following factors: language barriers, lack of public health care, unemployment, alcohol abuse, physical handicap, were considered as having a low social status (LSS). Cognitive status was scored by the trained nurse from 1 (normal) to 3 (confusion). Physical status was evaluated by the Steinbroker score. Prefracture treatments were recorded.

After hospitalisation, an after-fracture-programme (Fig. 1) was organised consisting of:

1) Education during the hospitalisation. The patients had a structured interview with a nurse who delivered precise information on OP and on the necessity of further treatment.

2) Organisation of further OP care was proposed after the patients' clinical records were reviewed with a hospital rheumatologist. The patients could choose to be directed to their general physician (GP), to their private rheumatologist (PR) or to the hospital rheumatologist (hospital-based care). In the latter case, they were given scheduled appointments for OP investigation and consultation at the hospital. In any case, a letter was sent either to the GP or to the PR in order to inform them of the fracture event and of the necessity of further care.

Analysis
Six months after the fracture event, the percentage of patients who had undergone OP investigation and treatment was telephonically evaluated, and the factors predicting the outcome were analysed. OP-investigation and/or proper OP treatment were considered as a positive outcome.

Statistical analysis
Normality was assessed by the Kolmogorov-Smirnov test. The after-fracture-program efficacy was evaluated with the Mc Nemar test. We identified patients-related variables that could be causally involved in the outcome, and for each the crude OR was calculated. These variables were then included in a stepwise multiple logistic regression model. The predictive accuracy of the model was evaluated with the ROC curve on positive and negative outcomes. All statistics were performed with MedCalc statistical software (MedCalc Software, Belgium).

Results

Patients' characteristics
Three hundred and forty-nine patients were included and 367 fractures identified (132 hip, 73 humeral and 73 wrist fractures). Only 7/133 patients who had at least one prevalent fracture had had an OP treatment before the index fracture with bisphosphonates (BP), calcium and vitamin D supplementation
Two hundred and four had a LSS. Eighty-six of them had had at least one prevalent fracture. Only 13/204 LSS patients were treated for OP before fracture compared to 13/35 not having LSS (p<0.0001). Moreover, the proportion of patients with LSS who did not receive an OP treatment during follow-up was 52.9% compared to 24.9% for all patients (p<0.05) (Table I).

Educational interventions
Of the 349 patients, 201 were interviewed by the nurse (Fig. 1); for 234 patients, letters to GP or PR were sent; for 74 this was the only form of education, while 156 had both the interview and the letter. Fifty-seven patients who had no GP and who were not available for the interview received a personally addressed letter.

Fig. 1. Study Outline.

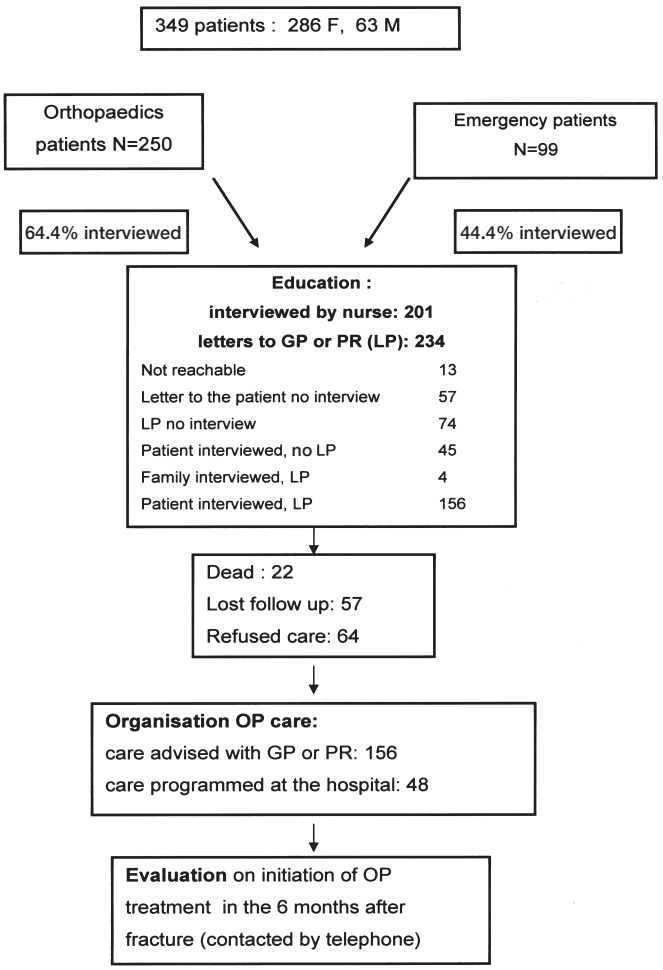

Table I. Patients demographics.

	All patients n=349	Orthopaedics n=250	Emergency n=99
Male-Female	63-286	49-201	14-85
Age	74.2 ± 13.2	75.8 ± 12.9	70.2 ± 12.9*
Low social status	86% (204/237)	87.9% (153/174)	80.9% (51/63)
Cognitive score =1	73.3% (242/330)	71.36% (172/241)	78.6% (70/89)
Steinbrocker ≤2	77.04% (255/331)	74.8% (181/242)	83.14% (74/89)
OP risk factors	81.3% (243/293)	84.37% (189/224)	78.26% (54/69)
At least one prevalent fracture	38.1% (133/349)	29.2% (73/250)	60.6% (60/99)†
Two prevalent fracture	10.02% (35/349)	10% (25/250)	10.1% (10/99)

*p<0.05 orthopaedics *vs*. emergency †p<0.0001 orthopaedics *vs*. emergency.

Organisation of subsequent OP care
Two hundred and four patients accepted further OP care: 48 at the hospital, 156 with GP or PR.

Diagnostic and therapeutic outcomes
After fracture event, 24.9% of patients were receiving proper OP treatment *vs*. 11.7% before (difference 13.2% [95% CI 7.93–16.99] p<0.0001) (Table II).
All patients who had OP care programmed at the hospital were investigated and 38/48 patients were treated in the 6 months after FF *vs*. 27/147 that had further OP care advised with GPs or PRs (p<0.0001).

Predictive factors of OP treatment initiation in the 6 months after FF
At univariate analysis, LSS conferred the lowest probability of treatment/investigation (OR 0.22 95%CI [0.09–

Table II. Treatment and investigation status in the 6 months after the fracture episode. Detailed treatment status before and after the intervention program was known for 265 patients.

	All patients (349)	Orthopaedics (250)	Emergency (99)
NA	75 (21.5%)	45 (18%)	30 (30.3%)*
No investigation, no treatment	163 (46.7%)	126 (50.4%)	37 (37.4%)*
Investigation, no treatment	4 (1.1%)	2 (0.8%)	2 (2%)
No Investigation, calcium and vit D supplementation	23 (6.6%)	16 (6.4%)	7 (7.1%)
Investigation, Ca and vit D supplementation	18 (5.2%)	12 (4.8%)	6 (6.1%)
No investigation, BP+Ca and vit D treatment	14 (4%)	11 (4.4%)	3 (3%)
Investigation +BP±Ca and vit D	52 (14.9%)	38 (15.2%)	14 (14.1%)

*$p<0.05$ orthopaedics *vs*. emergency.

Table III. Predictors of initiation of OP treatment in the 6 months after the fracture episode.

Variable	Crude OR [95% IC]	Adjusted OR [95% IC]
Age	0.982 [0.968–1.008]	1.0217 [0.9803–1.0649]
Male sex	0.4322 [0.1614–1.1571]	0.5913 [0.1930–1.8117]
Low social status	0.22 [0.09–0.47]	0.32 [0.12–0.86]
Low mental score	0.44 [0.24–0.79]	0.9165 [0.3617–2.3228]
In- *vs*. out-patients	1.0755 [0.5650–2.0472]	1.9079 [0.5037–7.2265]
Steinbroker >2	0.57 [0.39–0.85]	0.5884 [0.2999–1.1542]
Femoral fracture	0.6652 [0.3772–1.1730]	0.8372 [0.3326–2.1072]
Already treated	7.65 [3.59–16.31]	6.72 [2.07–21.88]
Education (interview with the nurse)	4.74 [2.15–10.44]	0.8372 [0.3326–2.1072]
Post-Education advised with GP or PR	15.91 [2.11–119.82]	8.82 [1.12–69.11]
Post-Education programmed at the hospital	26.74 [11.99–59.57]	118.09 [13.93–1000.92]

0.47]). Outcome positive predictors were: being already treated (OR 7.65; 95%CI [3.59–16.31]), organisation of subsequent OP care at the hospital (OR 26.74; 95%CI [11.99–59.57]), or with GP/PR (OR 15.91; 95%CI [2.11–119.82]) and education (interview *vs*. all other levels of education) (OR 4.74; 95%CI [2.15–10.44]). Fracture site was not involved in the outcome.

At multiple regression analysis, the most important predictive factor of further OP treatment was the organisation of OP care at the hospital (OR 118.09; 95%CI [13.93-1000.2]). Organisation of care with GP or PR (OR 8.82 95%CI [1.12–69.11]), already being treated (OR 6.72 [2.07–21.88]), and LSS 0.32 (OR 0.32 [0.12–0.86]) were the other predictive variables, while education and other patient-related factors were no longer significant.

Based on our regression model, in the 6 months after fracture, a patient who had OP care organised at the hospital and was not already treated, had a 66% absolute risk of positive outcome *vs*. 13% for those who where advised to see their GP or PR. Having LSS and consulting at the hospital confers a 52% absolute risk *vs*. 0.7 to 6.7% if no consultation is organised.

Our model had a predictivity of 89.9% (95% CI [0.848–0.937]).

Discussion

In this observational longitudinal study, the majority of patients entering the hospital for osteoporotic fracture were under 80 years of age, had a good physical and cognitive status before fracture, a high risk of further fracture and a LSS. Post-fracture OP treatment initiation seems to be linked more to the type of organisation after fracture and patients characteristics than to education.

Few studies examined the barriers hindering post-fracture OP investigation and treatment (5, 6). Fracture event did not substantially increase OP treatment (7). Al-Allaf *et al*. (8) found an increase of OP treatment from 7% before, to only 11% after hospitalisation for FF, others (9) reported even a decrease in treatment from 13% to 9.7%.

Our results show an increase of treatment after FF, with an effect size that remains, nevertheless, low (24.9% *vs*. 11.7%). An improvement of the situation after information-based intervention was found by other authors who tested programs of investigation/treatment of OP (10) especially with structured programs: Rozental *et al*. (11) showed that organising a bone mineral densitometry after wrist fracture increases the initiation of anti-osteoporotic treatment compared to a letter sent to GP. The barrier might consist in the fragmented OP management itself (12): orthopaedic surgeons, geriatricians, GPs, and rheumatologists each providing part of the patient's care with lack of continuity of care and of communication.

Our results suggest that, when attempting to increase OP care after fracture in real-life, educational efforts aimed at increasing patients' awareness on OP should be integrated with a proper organisation of further OP care. Conversely, the education of the patient by the nurse is not a strong predictor of positive outcome in this study. A recent multicentric study (13) underlines that postmenopausal women are not aware of their real fracture risk. Nevertheless, the proper way to educate patients has not been established yet, but new tools like the FRAX might help (14).

The link between patients' characteristics and OP care after fracture has not been extensively studied. Age less than 50 years and male sex have been suggested to be negative predictors of further OP care. We found that a LSS was the strongest negative predictor. Some studies (15) found that poverty is a risk factor for osteoporotic fracture and that postmenopausal women with low socio-economic status had a higher prevalence of densitometric OP and fracture. In fact, we show that LSS patients had an extremely low rate of pre and post-fracture OP treatment. These data suggest that a LSS may thwart

access to optimal medical care and be an additional barrier to OP treatment.
The study limitations are those of a monocentric observational study. The choice of further OP care was left to the patients and this might introduce a bias favouring more motivated subjects. Nevertheless, since the study aimed at observing patients OP care in a real-life scenario, we chose a purely observational approach.

Conclusion

Our study shows that the organisation of the patient's schedule after hospitalisation for FF strongly determines successful OP treatment initiation. Initiatives aimed at increasing OP treatment should deal with this aspect of patient's care, independently of education on OP. Patients with a LSS are at increased risk of being untreated and additional efforts to organise their further OP care are warranted.

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