Original article

A coordination project for improvement of osteoporosis medication use among patients who sustained an osteoporotic fracture: The Israeli experience

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A B S T R A C T

Objectives: The aim of this study was to examine whether coordination between healthcare providers at an inpatient rehabilitation facility and healthcare providers in a community setting improves osteoporosis medication use in the community.
Methods: In 2012, a coordination project between an inpatient geriatric rehabilitation facility located in north-central Israel and general practitioners in the community setting was initiated. In this retrospective pseudo-experimental study, we compared osteoporosis medication use among patients who were hospitalized at the facility following an osteoporotic fracture during 2011—2012, and who constituted the control group (n=120), and patients who were hospitalized at the facility during 2013—2015, and who constituted the trial group (n=129). Data were collected from the patients' records and from records of the health maintenance organization concerning medications issued to the patients by pharmacies.
Results: Differences were observed between the trial and the control group in osteoporosis medication management by healthcare providers, both at the inpatient rehabilitation facility and in the community, suggesting favorable trends. However, osteoporosis medication use in the community was slightly lower in the trial group, then in the control group (32.8% vs. 34.2%, respectively). A regression analysis indicated that the only variable predicting use of osteoporosis medications in the community was a previous diagnosis of osteoporosis in the community.
Conclusions: The study results indicate that mere coordination between the healthcare settings is insufficient in order to ensure continued care in the community, emphasizing the need for an osteoporosis coordinator.

1. Introduction

The incidence of osteoporotic fractures is rising with aging of the population. Osteoporotic fractures are a cause of significant morbidity, impaired functioning, inpatient stays at long-term facilities, and mortality, posing a burden on individuals, their families, and society as a whole [1—3]. In a survey conducted in 6 European countries, the estimated cost of osteoporotic fractures care was 30.7 billion euros, which constituted 3.5% of the overall health expenditure in these countries. Of note, the major part of the overall cost was incurred for acute fracture care [2].

Studies indicate that initial osteoporotic fractures double the risk of second osteoporotic fractures [4]. In a meta-analysis by Kanis et al. [5], a history of an initial osteoporotic fracture has been shown to substantially increase the risk for a second fracture, beyond the risk conferred by bone mineral density measurements. In contrast, osteoporosis medication use has been shown to reduce the risk of a second fracture by 50% [3]. As second fractures have a worse prognosis than initial fractures, osteoporosis medication use among patients who have already sustained an osteoporotic fracture is of extreme importance [6].

Recent studies indicate that osteoporosis medication use among patients who have already sustained an osteoporotic fracture is low

[7–11]. One reason for the low rates of osteoporosis medication use is the failure to achieve continued care of patients following an initial osteoporotic fracture, upon transition between healthcare settings, that is, the so called osteoporosis treatment gap [12]. Thus, patients discharged after acute and postacute fracture care in an inpatient setting often are not evaluated for osteoporosis and do not receive the osteoporosis pharmacotherapy in the community, with the rate of osteoporosis medication use being lower than 20% [13].

One reason for the failure to achieve continued care of patients who sustained an osteoporotic fracture is deficient communication between physicians at inpatient facilities and general practitioners (GPs) in the community with regard to patients who have sustained an osteoporotic fracture [8,14]. An Israeli study also pinpointed the absence of recommendations at discharge and the absence of communication between healthcare settings as leading causes of failure of secondary prevention of osteoporotic fractures [15].

Studies have shown that various programs coordinating between healthcare settings improve the rates of medication prescription for osteoporosis [16], improve osteoporosis medication use [17], and thus reduce the incidence of second fractures [18,19]. A previous Israeli study showed that coordination between an inpatient facility and community healthcare services improved rates of treatment with Vitamin D and calcium. Thus, rates of treatment with Vitamin D and calcium were found to be higher among patients following hip fracture who were discharged to their home with a recommendation to receive Vitamin D and calcium treatment [20]. Nonetheless, it is not known whether coordination between the healthcare settings might lead to similar improvement in osteoporosis medication use in the community. It should be noted that another factor that may impede osteoporosis medication use in Israel is that these medications require special approval by the insuring health maintenance organization (HMO), and are not provided directly to the patient based on the prescription of a GP. Although Israel has a national public health system that covers other aspects of osteoporosis care, not all medications are included on the official list of drugs whose costs are covered by the public health system. In Israel this list is referred to as the "basket of (covered) medications." Because osteoporosis medications are only included in the national "basket of medications" under certain circumstances, their cost will only be covered by patients' HMOs if the patient applies for and obtains approval from the HMO. This approval is based on whether or not the HMO determines that the individual patient's clinical situation necessitate the provision of medication, as per the basket's indication criteria. Because osteoporosis medications and treatments are expensive, patients who are not granted approval may not be able to obtain the treatment recommended by an inpatient facility. This represents a significant barrier for many patients and their families.

The purpose of the present study is to examine whether coordination between healthcare providers at an inpatient rehabilitation facility and healthcare providers in a community setting leads to improvement in osteoporosis medication use in the community, among patients following an osteoporotic fracture.

2. Methods

In 2012, the medical team at the rehabilitation department of the geriatric medical center initiated a coordination project between the rehabilitation facility and community healthcare services, with the aim of ensuring continued osteoporosis pharmacotherapy for patients who had been admitted to the rehabilitation department following an osteoporotic fracture and been discharged to the community. In this project, meetings were held between representatives of the department and representatives of the insuring HMO, by the end of which there was a consensus over the following steps:

(1) The physicians in charge at the rehabilitation department would identify osteoporosis patients, together with a physician in charge of medication approval, representing the HMO.
(2) Based on the medical background and indications of the government-funded healthcare basket, the appropriate medication would be approved for each patient.
(3) The GP would receive information on approval of the medication through the computerized system.
(4) The medication would be prescribed to the patient.
(5) According to the type of medication, the patient would start treatment at the rehabilitation department and receive an explanation and guidance on osteoporosis and the importance of continued treatment.
(6) A detailed recommendation would be included in the discharge letter concerning the appropriate medication.

Treatment decisions took into account verification of a sufficient level of Vitamin D, without which it is not possible to prescribe designated medications. Patients' Vitamin D levels were checked after Vitamin D loading following admission. The staff checked whether the fracture had occurred under medication attesting to treatment failure, contraindications of using certain medications (such as renal function, malignancy, and prior radiation), patient preferences, and indications of the government-funded healthcare basket of medications. The topic of patient preferences is a significant element in prescribing treatment, as the routes of administration differ, as well as the frequency of administration. Thus, oral medications may be administered daily, weekly, or monthly. In contrast, zoledronic acid is administered intravenously once a year, denosumab is administered subcutaneously twice a year, and teriparatide is administered by daily subcutaneous injections [3].

Of note, before the project was initiated, patients who were discharged from the rehabilitation department only received a written discharge letter with detailed recommendations concerning osteoporosis medication.

This study is a retrospective pseudo-experimental study. The study consisted of a convenience sample of 249 patients who had been inpatients at the rehabilitation department of a large geriatric medical center located in north-central Israel during 2011–2015. Inclusion criteria were: age 65 and older, diagnosis of an osteoporotic fracture, and being insured by the Clalit Health Services HMO in the Sharon-Shomron district. Exclusion criteria were: dialysis patients and patients who were discharged before completing the diagnostic process for osteoporosis.

The study was approved by the institutional Helsinki Committee at the geriatric medical center (Institutional Review Board approval number: 1.17). Based on examination of the records of patients admitted to the rehabilitation department during 2011–2015, we created 2 groups of patients: patients admitted before initiation of the project, during 2011–2012 (48.2%, n=120), constituting the control group, and patients admitted after initiation of the project, during 2013–2015 (51.8%, n=129), constituting the trial group.

The following demographic and clinical data were collected from the records of patients who met the inclusion criteria: sex, age, type of fracture, previous fractures, creatinine clearance test (CCT), length of stay at the rehabilitation department, discharge destination, timing of the osteoporosis diagnosis (before or during stay at the rehabilitation department), whether the patient had received designated treatment in the community before the fracture, osteoporosis medication received at the rehabilitation department, type of osteoporosis medication recommended in the

discharge letter, and survival after discharge from the rehabilitation department. Data on osteoporosis medication use in the community were collected from the computerized system of the insuring HMO, which provided information regarding medications issued to the patients at community pharmacies. The records were inspected up to November 2016.

Data analysis was performed using IBM SPSS Statistics ver. 21.0 (IBM Co., Armonk, NY, USA). The data were presented by means of descriptive statistics (means, standard deviations, and frequencies). The comparison between the control group and the trial group was performed using chi-square tests for categorical variables and t-tests for independent samples for continuous variables. In addition, a logistic regression was conducted to identify predictors of osteoporosis medication use in the community after discharge from the rehabilitation department. Statistical significance was set at P<0.05.

3. Results

3.1. Sociodemographic and clinical characteristics of the sample

The study included 249 patients; most were women (n=181, 72.7%), with a mean age of 79.5 (standard deviation [SD], 0.1; range, 80–102). Most were admitted for a hip fracture (n=207, 83.1%); 39% (n=96) had had an osteoporotic fracture in the past (mean ± SD, 1.3 ± 0.71; range, 1–4). Mean CCT among the patients was 75.3 (SD, 42.3; range, 9.90–356). Most were ranked for renal function at stage 2 (n=73, 29.2%) or 3 (n=83, 33.2%).

Mean length of stay at the rehabilitation department was 29.17 days (SD, 17.2; range, 0–179). Most of the patients were discharged to their home (n=203, 81.5%). During the follow-up period after discharge from the rehabilitation department, 22% of patients (n=55) died, while the survival ranged between 22 and 1484 days from the time of discharge, with a median of 298 days. Thirteen percent of the patients (n=32) died in the first year after discharge from the rehabilitation department. Note that there were no statistically significant differences in the characteristics of the study group (n=129) and the control group (n=120) (Table 1).

Only 28.1% of the patients (n=70) had had an osteoporosis medication prescribed for them before admission to the rehabilitation department. Of these, most (n=46, 66%) had taken bisphosphonates in the community before admission, while a minority had taken teriparatide (n=3, 4.3%), denosumab (n=2, 2.9%), and raloxifene (n=1, 1.4%).

Data on past diagnosis of osteoporosis were available in the records only for the trial group (n=129), as this information was regularly recorded only from 2012, after initiation of the coordination project. Thus, in the trial group, 58.1% of the patients had not been diagnosed with osteoporosis in the community before the fracture for which they were admitted (n=75), 10.9% had been diagnosed with osteoporosis in the community but had not received medication (n=14), while 31% of the patients had been diagnosed with osteoporosis and had received designated medication (n=40).

Only patients from the trial group (n=129) were given the designated medication while at the rehabilitation department; thus, 64 patients in total (49.6%) received medication before their discharge. Of these, 62.5% received zoledronic acid (n=40), 18.8% denosumab (n=12), and 18.8% teriparatide (n=12). Forty-four patients (68.8%) from the trial group who had been given the designated medication while at the rehabilitation department (n=64) received no medications in the community. Only 14 patients (21.9%) of those who had received the designated medication while at the rehabilitation department continued to receive the same medication in the community. Of these, 5 patients received denosumab

and nine received teriparatide.

3.2. Comparison between the trial and the control groups

A comparison between the trial and the control groups showed no differences between the 2 groups in their sociodemographic and clinical characteristics (sex, age, CCT, length of stay in the rehabilitation department, type of present fracture, discharge destination, and survival).

The study results indicate that a slightly lower proportion of patients in the trial group were issued osteoporosis medications in the community, compared to the control group, 33.8% versus 34.2%, respectively (chi-square=14.8 [df=5], P=0.06). Differences were observed between the trial and the control group in the types of osteoporosis medications that were issued. Thus, a smaller proportion of patients in the trial group were issued oral bisphosphonates, compared to the control group (7.8% vs. 18.4%, respectively), while a larger proportion of patients in the trial group were issued zoledronic acid (6.9% vs. 3.5%, respectively) and teroparatide (12% vs.4.4%, respectively). In contrast, the proportion issued denosumab remained similar in both groups (Table 2).

In addition, differences were observed between the trial and the control group in the types of osteoporosis medications that were recommended in the discharge letter (chi-square = 18.8 [f = 5] P < 0.01) Thus, a smaller proportion of patients in the trial group received a recommendation of oral bisphosphonates (7.8% vs. 31.7%, respectively). Additionally, a smaller proportion of patients in the trial group received a recommendation of teroparatide (15.5% vs. 22.5%, respectively). In contrast, a significantly higher proportion of patients in the trial group received a recommendation of zoledronic acid (56.6% vs. 32.5%, respectively). Moreover, a higher proportion of patients in the trial group received a recommendation of denosumab (12.4% vs. 3.3%, respectively). No change occurred in the proportion of patients referred to the clinic for further medical evaluation. Finally, the difference in the proportion of patients who received no recommendations was negligible (Table 3).

A regression analysis showed that the only variable predicting issuing of osteoporosis medication in the community after discharge from the rehabilitation facility was a previous diagnosis of osteoporosis in the community. Namely, all the patients who had a previous diagnosis of osteoporosis and had previously received medication, continued to receive the medication (n=40, 31%).

4. Discussion

The present study examined whether coordination between an inpatient geriatric rehabilitation facility and community healthcare services improved communication between physicians at the inpatient setting and community based primary care physicians, and led to improvement in osteoporosis medication use in the community among patients who had sustained an osteoporotic fracture. In this study positive trends were observed in osteoporosis medication management by healthcare providers, both at the inpatient rehabilitation facility and in the community, following initiation of the coordination project.

Thus, one positive effect found in the present study, which may be attributed to the coordination project, is a change in osteoporosis medication recommended upon discharge from the rehabilitation facility. Following the coordination project, an increase in recommendation for zoledronic acid and denosumab, while a reduction in recommendation for oral bisphosphonates and for teroparatide, were observed. These trends may reflect consideration of literature recommendations, patient adherence, patient medical condition, as well as consideration of constraints of the government-funded basket of medications, which might have been

Table 1
Demographic and clinical characteristics of the patients (n=249).

Variable	Control group (n=120)	Trial group (n=129)
Sex		
Male	90 (75)	93 (72)
Female	30 (25)	36 (28)
Age, yr		
Mean ± SD (range)	79.6 ± 10.1 (80—102)	79.4 ± 10.2 (80—100)
Location of fracture		
Hip	104 (80.6)	106 (82.2)
Pelvis	8 (6.2)	11 (8.5)
Vertebra	5 (4.1)	7 (5.4)
Other	1 (0.8)	1 (0.8)
Wrist	1 (0.8)	1 (0.8)
No fracture	1 (0.8)	1 (0.8)
Past fracture event		
Yes	46 (39)	51 (39)
Mean ± SD (range)	1.3 ± 0.71 (1—4)	1.4 ± 0.73 (1—4)
No	74 (61)	78 (61)
Creatinine clearance test		
Mean ± SD (range)	75.28 ± 42.3 (9.90—356)	76.12 ± 42.3 (9.97—351)
Length of stay		
Mean ± SD (range)	29.17 ± 17.2 (0—179)	28.89 ± 17.3 (0—177)
Renal disease		
Stage 1	41 (34.1)	41 (31.8)
Stage 2	36 (30)	37 (28.6)
Stage 3	41 (34.1)	42 (32.5)
Stage 4	10 (8.3)	10 (7.8)
Stage 5	1 (0.8)	2 (1.5)
No renal disease	14 (11.6)	13 (10)
Destination of discharge		
Home	100 (83.3)	103 (79.8)
Long-term facility	11 (9.1)	12 (9.3)
Transfer to emergency room	11 (9.1)	12 (9.3)
Death during period from discharge to end of follow-up		
Yes	27 (22.5)	28 (21.7)
No	94 (78.3)	100 (77.5)
Death during one year from discharge		
Yes	16 (13)	17 (13)

Values are presented as number (%) unless otherwise indicated.
SD, standard deviation.

Table 2
Medications issued in the community: control versus trial group[a].

Group	Oral bisphosphonates	Teriparatide	Denosumab	Zoledronic acid	Total
Control	22 (18.4)	5 (4.4)	9 (7.5)	3 (3.5)	120 (100)
Trial	10 (7.8)	15 (12)	9 (6.9)	9 (6.9)	129 (100)

Values are presented as number (%).
[a] χ^2=14.8 (df=5), P=0.06.

Table 3
Medication recommendations in the discharge letter from the rehabilitation department: control versus trial group[a].

Group	Oral bisphosphonates	Teriparatide	Denosumab	Zoledronic acid	Not recommended	Clinic evaluation	Total
Control	38 (31.7)	27 (22.5)	4 (3.3)	39 (32.5)	2 (0.2)	10 (8.3)	120 (100)
Trial	10 (7.8)	20 (15.5)	16 (12.4)	73 (56.6)	0 (0)	10 (7.8)	129 (100)

Values are presented as number (%).
[a] χ^2=18.8 (df=5), P<0.01.

previously considered to a much lesser extent. Consideration of literature recommendations may explain increase in recommendation for zoledronic acid, which is recommended by the literature as a bisphosphonate of choice [21,22]. Consideration of patient adherence may explain increase in recommendation for zoledronic acid and for denosumab. Zoledronic acid is administered intravenously once a year [23], while denosumab is administered subcutaneously twice a year, thus increasing patient cooperation [24]. Consideration of patient medical condition may explain increase in recommendation for denosumab, as it is the only treatment indicated for patients with renal failure [25]. Consideration of constraints of the government-funded basket of medications may explain reduction in recommendation for teriparatide, which is an expensive drug, financed by the Israeli government-funded healthcare basket only for those who have a fracture while receiving an antiresorptive therapy and who have no contraindications.

Another positive effect found in the present study, which may be attributed to the coordination project, is a consistence between a change in the osteoporosis medication recommended by the

rehabilitation facility and a change in osteoporosis medications used in the community. Thus, reduction in recommendations for oral bisphosphonates in the discharge letters was consistent with reduction in issuing oral bisphosphonates in the community. Similarly, increase in recommendations for zoledronic acid in the discharge letters was consistent with an increase in issuing this medication in the community. At the same time, the increased issuing of teroparatide in the community is not consistent with the reduction in recommendations for this medication at the facility. This finding is unclear and the reasons for this inconsistence should be explored. The finding may reflect differences in the professional considerations of healthcare providers. Primary care physicians are not obliged to follow the recommendations given at the facility, and it must be noted that these physicians see the patient over time.

The study results indicate that contrary to the expected, despite the improved communication between the inpatient rehabilitation setting and the community healthcare services, the coordination project had no significant effect on the rate of osteoporosis medication use in the community, which remained low, at nearly 30%. Moreover, it was found that the only variable predicting osteoporosis medications use in the community was a previous diagnosis of osteoporosis in the community. These findings are not consistent with previous studies that examined coordination programs between healthcare settings in other countries and which reported improved outcomes in patients with osteoporosis-related fractures, including treatment initiation and adherence to treatment [26].

The coordination project presented in this study was based on the concept of fracture liaison service (FLS), which is a coordinated, multidisciplinary, and proactive model of care, based in secondary or primary care, whose aim is to address the osteoporosis treatment gap [27]. The FLS process includes identification of patients with osteoporotic fracture in a clinical setting, diagnosing osteoporosis, education of patients and their families with regard to osteoporosis care, individualizing osteoporosis medication based on the patient's medical history and insurance, and follow-up care [28]. Interestingly, the project presented in our study resembles type A of FLS model, as described by Ganda et al. [29], which identifies, investigates, and initiates treatment, that is, performs all these activities by itself. However, the coordination project lacked a coordinator that would take responsibility for the whole process, from patient identification through to investigation, treatment for osteoporosis, and long-term follow-up to ensure adherence. Rather, the physicians in charge at the rehabilitation department themselves were in contact with the GPs regarding their patients. Moreover, in our project, a component of follow-up, to ensure continuation of treatment, was lacking, probably, due to lack of a coordinator. The lack of coordinator may therefore explain the lack of improvement in osteoporosis medication use. Studies have shown that coordinator-led services, often by a clinical nurse specialist, had the best outcomes [28]. It should be noted that the lack of coordinator in our project did not seem to affect the osteoporosis medication management.

In addition, it should be noted that the study results are not consistent with the results of a previous Israeli study that found that coordination between healthcare settings is associated with improved rates of treatment with Vitamin D and calcium in patients after hip fracture [20]. This inconsistence may result from the fact that osteoporosis medication is more complex, with more potential side effects, and also more expensive.

This study has several limitations. It was conducted at only one inpatient rehabilitation facility and one HMO, thus limiting the generalizability of the study results. In addition, this study had a retrospective pseudo-experimental design, thus limiting the ability to determine cause and effect.

5. Conclusions

The coordination project presented in this study did not lead to an improved rate of osteoporosis medication use but it did lead to a certain improvement in osteoporosis medication management. It seems that one possible reason for the lack of improvement in osteoporosis medication use is lack of a coordinator. However, further research to clarify the reasons of the lack of improvement in osteoporosis medication is warranted.

Conflicts of interest

No potential conflict of interest relevant to this article was reported.

Acknowledgments

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