

Fracture Liaison Service for Hip Fractures: Is It A Game Changer?

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ABSTRACT **Background:** Osteoporosis is a common medical condition in older ages. A devastating result of osteoporosis may be a hip fracture with up to 30% mortality rate in one year. The compliance rate of osteoporotic medication following a hip fracture is 20% in the western world.

Objectives: To evaluate the impact of the fracture liaison service (FLS) model in the orthopedic department on patient compliance following hip fracture

Methods: We performed a retrospective review of all patients with hip fracture who were involved with FLS. We collected data regarding kidney function, calcium levels, parathyroid hormone levels, and vitamin D levels at admission. We educated the patient and family, started vitamin D and calcium supplementation and recommended osteoporotic medical treatment. We phoned the patient 6–12 weeks following the fracture to ensure treatment initiation.

Results: From June 2018 to June 2019 we identified 166 patients with hip fracture who completed at least one year of follow-up. Over 75% of the patients had low vitamin D levels and 22% had low calcium levels at admission. Nine patients (5%) died at median of 109 days. Following our intervention, 161 patients (96%) were discharged with a specific osteoporotic treatment recommendation; 121 (73%) received medication for osteoporosis on average of < 3 months after surgery. We recommended injectable medications; however, 51 (42%) were treated with oral biphosphonate.

Conclusions: FLS improved the compliance rate of osteoporotic medical treatment and should be a clinical routine in every medical center.

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fracture every 3 seconds [2]. Women are more prone to osteoporotic fractures with 70% and 58% of hip and spine fractures, respectively. Overall, most osteoporosis fractures occur in women, with a female-to-male ratio of 1.6 [2]. A major diagnostic tool for osteoporosis diagnosis is bone mineral densitometry (BMD) with the definition of osteoporosis a value of less than -2.5.

Although low BMD is a risk factor for fracture, most fractures occur in postmenopausal women [3] and elderly men without known osteoporosis per BMD definition [4]. Osteoporotic fracture is common and the combined lifetime risk for fractures is approximately 40%, which is almost the same as the risk for cardiovascular disease [5]. Patients should be diagnosed for osteoporosis before sustaining a fracture, thus, obtaining primary prevention. However, once a fracture occurs it is associated with an 86% increased risk of any fracture [6] and requires secondary prevention. Evidence suggests that many women who sustain a fragility fracture are not appropriately diagnosed and treated for probable osteoporosis [7]. Most patients at high risk who have already had at least one osteoporosis fracture are neither identified nor treated [8]. The most dangerous and morbid fracture is hip fracture. Hip fractures are associated with major morbidities including chronic pain, reduced mobility, and disability [9]. The overall mortality is about 20% in the first 12 months after hip fracture and is higher in men than women [10].

Osteoporosis takes a huge personal and economic toll. In Europe, the disability due to osteoporosis is greater than that caused by some cancers and is even greater than that lost to other chronic diseases such as rheumatoid arthritis and asthma [2]. The morbidity among hip fracture survivors is profound, with 40% unable to walk independently and 60% requiring assistance one year later [11]. Because of these losses, 33% are totally dependent or in a nursing home in the year following a hip fracture [12].

The fracture gap describes the gap between the known osteoporosis from previous fracture and the low rate of osteoporosis treatment to those patients. In 2012 the ASBMR task force published its recommendation for closing that gap with the fracture liaison service (FLS) model [13]. A FLS model is a coordinated model of care for secondary fracture prevention. It ensures that all patients 50 years of age or over who present to urgent care

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Osteoporosis is a common medical condition in the elderly population. It affects an estimated 75 million people in Europe, United States, and Japan [1]. The most devastating result of osteoporosis is fracture. Worldwide, osteoporosis causes more than 8.9 million fractures annually resulting in an osteoporosis

services with a fragility fracture, undergo fracture risk assessment and receive treatment in accordance with prevailing national clinical guidelines for osteoporosis.

In Israel the compliance for osteoporosis workup following a fragility fracture is as low as worldwide [14]. In recent years, we have created a FLS model that is embedded in the orthopedic department.

We present our results of the impact of FLS in the orthopedic department on patient compliance to osteoporosis medication following hip fracture.

PATIENTS AND METHODS

We conducted a retrospective review of all patients who presented with hip fracture who were involved with the FLS from June 2018 until June 2019 and completed follow-up of at least one year. All patients were admitted and treated in a single medical center. The hospital ethics committee approved this study.

THE FLS CLINIC FLOW CHART AND TREATMENT

Patients who entered the FLS clinic were treated as follows. All patients with hip fractures were admitted to the orthopedic department and underwent surgery within 48 hours (three patients were operated within 72 hours). The FLS team was notified when patients were admitted, and complete bone metabolic workup was completed. The workup consisted of blood tests and medical interview. The routine blood tests included complete blood count, kidney function tests, liver functions tests, albumin, calcium and phosphor levels, parathyroid (PTH) and thyroid stimulation hormone (TSH) levels, and vitamin D levels. The medical interview focused on the Fracture Risk Assessment Tool (FRAX) to identify risk factors for osteoporosis or non-naïve to treatment patients. Following the test results, a treatment plan was discussed and recommended with the patient and caregiver. In complicated cases an endocrinology consultation was conducted. All patients received calcium and vitamin D. Our protocol is 2000 IU of vitamin D once daily unless the levels are below 20 ng/ml in which case a loading dose of 75,000 IU is given immediately. In addition, 1200 mg of calcium once daily was recommended. A discussion with the patient and caregiver was conducted to amplify the importance of the osteoporotic treatment. In addition to the medical treatment recommendation, patient education for fall preventions, diet, and general health was discussed. A follow-up 6-12 weeks

after discharge was scheduled with the FLS coordinator, who contacted the patients and verified the treatment recommendation and compliance. If required, second contact was scheduled as needed to ensure that the recommendations were fulfilled.

DATA COLLECTION

We collected data regarding age, gender, and kidney function as well as levels of calcium, PTH, TSH, and vitamin D at admission. Dates of admission, discharge, and treatment initiation were noted.

STATISTICAL ANALYSIS

Continuous data were presented as mean ± standard deviation. Categorical data were presented as frequencies and proportions. Bivariate analyses were conducted using chi-square test and Fischer’s exact test. Statistical analyses were performed using IBM Statistical Package for the Social Sciences statistics software, version 24 (SPSS, IBM Corp, Armonk, NY, USA).

RESULTS

From June 2018 until June 2019, 166 patients with hip fracture were admitted and followed for at least one year (until June 2020) at our department. The mean age was 77 years old, with 99 female patients (60%) [Table 1]; 85 patients (51%) presented with a left side hip fracture. The most common surgical treatment was proximal femoral nail antirotation (PFNA) [Table 2]. All but three patients were operated within 48 hours. Due to their medical status, the three patients required longer preparation for surgery. The mean hospitalization time from admission to discharge was 8 days [Table 1].

BLOOD TESTS RESULTS

Mild anemia was noted in 50% of patients (11 g/dl), 22% of patients had hypocalcemia below 2.08 mmol/lit, 50% of patients had low vitamin D levels below 20 ng/ml and 75% below 30 ng/ml (the recommended level following hip fracture), 50% of patients had renal failure of glomerular filtration rate (GFR) lower than 60 ml/min, 25% of patients had high PTH levels above 8.5 pmol/lit, 18% of patients had low phosphorus levels below 0.8 mmol/lit.

Osteoporosis treatment was recommended for 161 patients (96%). Seven patients (4%) did not have any medical recommendation for osteoporosis treatment. Most of them were referred to the endocrinology clinic due to complicated medical status such as chronic renal failure and dialysis treatment. The

Table 1. Demographics of patients with hip fractures

	Number	Minimum	Maximum	Mean ± standard deviation
Age, years	166	48	103	77.13 ± 10.588
Body mass index, kg/m ²	137	18	47.6	25.511 ± 4.7373
Time to surgery, days	166	0	3	0.97 ± 0.700
Hospitalization time, days	166	3	42	8.35 ± 5.000

Table 2. Surgical treatment

	Number	%
Hemiarthroplasty	38	22.9%
Cannulated screws	6	3.6%
Percutaneous compression plate	10	6.0%
Proximal femoral nail antirotation	111	66.9%
Total hip replacement	1	0.6%

most common recommendation was denosumab in 94 patients (57%), followed by zoledronic acid in 50 (30%) and teriparatide for 15 patients (9%). Data were unavailable for 7 patients.

With regard to treatment, 121 (73%) patients received medical treatment for osteoporosis and 40 did not receive medical treatment. In 5 patients data were unavailable due to death (4 patients) and one was unclear. Oral bisphosphonate was being given to 51 patients (42%) despite our recommendation for injectable medication. For most patients, the time for medical treatment was less than 3 months with an average of 74 days [Table 3].

In our cohort of 1 year, 9 patients (5%) died. Another patient died during hospitalization and was not evaluated for osteoporosis treatment. She was transferred to the internal ward and died 19 days post-surgery and therefore was excluded from our study. The time of death from surgery was less than 4 months with median of 109 days. A trend was found for higher mortality in older patients ($P = 0.06$) with mean age of 82 years old. Four patients (80%) who died did not receive medical osteoporosis treatment ($P < 0.001$). No significant statistical difference was found between patients who died to patients who did not die with regard to sex, side of fracture, surgical treatment, time to surgery, hospitalization time, body mass index, and blood tests results.

DISCUSSION

The FLS intervention in our medical center showed good results. As expected, most patients were females and all patients except three were operated within 48 hours according to Israel national guidelines. A discussion and treatment recommendation for osteoporosis treatment was conducted with 96% of patients and 73% received medical treatment for osteoporosis, which is almost 4 times better than the published literature without intervention. Most patients (75%) had lower than recommended vitamin D levels and 20–50% had several blood test abnormalities that represent co-morbidity and fragile state. The

death rate was exceptionally low and 5% of patients died within one year. These results stress the need for FLS.

Nearly 75% of all hip fractures occur in women [15]. In our cohort, the percentage of men was higher than expected without any obvious reason.

Vitamin D is crucial for bone and muscle health. It is common for hip fracture patients to have low vitamin D levels [16]. Our results of high percentage of patients with low vitamin D levels are not surprising even though we live in a sunny climate. This dichotomy may be related to the cultural dress codes of strict Muslims and ultra-Orthodox Jews as well as patients who stay indoors and are not exposed to sunlight. Family physicians and patients should discuss the importance of routine vitamin D supplementation. It is of high importance to evaluate and treat low vitamin D levels during admission. This action should enable faster recovery and shorten the time for treatment. All osteoporosis medication requires normalized vitamin D levels before initiation of treatment.

Although the huge personal and economic toll the diagnosis and compliance rate worldwide are still low. In 2013 the International Osteoporosis Foundation launched the Capture the Fracture® project to close the fracture gap. The reasons for that gap are numerous including bureaucratic obstacles, fragile patients with low general compliance, undiagnosed patients, severe co-morbidities, and limited access to medical treatment. FLS have been shown to dramatically improve osteoporosis treatment rates for fragility fracture patients and reduce secondary fracture incidence [17].

With the FLS embedded in the orthopedic department, we were able to evaluate and make recommendations for almost all hip fracture patients. Once patients were discharged, the coordinator continued the follow-up, thus addressing obstacles such as contacting the family physician, obtaining treatment approval, and reminding the patient of the importance of the treatment. This intervention has dramatically improved the compliance rate and should be implemented at every medical center.

Our cohort showed extremely lower rates of death despite a higher percentage of male patients than expected. The patients who died were older (statistical trend) but without any other significant differences. Reported mortality rates following hip fracture are up to 20–24% in the first year [12], with greater risk of dying for at least 5 years after [18]. Men have higher rates of fracture-related mortality despite the higher rate of fracture in women [10]. This statistic is true for hip fractures, where a reduction in life expectancy and excess mortality was observed at a higher level in men compared to women, even after considering co-morbidities, medications, and changes in background mortality [19].

Table 3. Death and time for treatment

	Number	Minimum	Maximum	Mean ± standard deviation
Time to medical treatment, days	123	15	193	73.99 ± 35.114
Time to death, days	9	17	176	99.89 ± 68.362

In our cohort 80% of the patient who died did not receive medical treatment for osteoporosis within several months after surgery; however, medical treatment for osteoporosis is known to reduce mortality by 28% [20]. The low number of patients who died is insufficient for solid statistical analysis. Other possible explanations for lower death rates may be related to our FLS work plan and multidisciplinary team. All patient medications are routinely examined by clinical pharmacist, and abnormal metabolic bone blood test results are addressed and fixed. Based on these findings, it is clear that FLS reduced the mortality rate. Patients followed in a FLS in the Netherlands had a significant reduction in mortality of 35% over 2 years when compared with those who underwent standard non-FLS care [21].

LIMITATIONS

This retrospective cohort included internal limitation that relied on good data documentation. The results are compared to known results without a control group. There are past research results, which are sufficient for comparisons.

The low number of patients who died limits the statistical analysis. Objective and subjective functional analysis was unavailable for risk stratification due to the nature of the study.

FUTURE DIRECTIONS AND INVESTIGATION

The FLS should be part of every medical center that treats osteoporotic fracture. It should capture all fragility fractures including pelvis, proximal humerus, vertebral, and wrist. The secondary prevention starts after the first fracture. To achieve this goal, more resources are required to identify and coordinate care of such patients. On a national level, some steps were taken such as national quality indicator for osteoporosis treatment following hip fracture; however, much more is needed to be done.

CONCLUSIONS

Hip fracture is a devastating medical condition with high mortality and morbidity. The incorporation of FLS into the orthopedic department is a game changer. In our retrospective cohort the compliance rate for osteoporosis medication treatment improved dramatically—to 73% of patients—with a major decrease in mortality to 5%. The FLS should be implemented in medical centers in Israel.

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