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Does a fracture liaison service program minimize recurrent fragility fractures in the elderly with osteoporotic vertebral compression fractures?

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ABSTRACT

Background: There is a sizable proportion of elderly, both men and women, with fragility fractures, approximately 2 million fractures per year in the United States.
Methods: A retrospective chart review of 365 patient presented between January 2012 and December 2017 with vertebral compression fractures. Pre-post study design to determine refracture between Group A (before Fracture Liaison Service (FLS)) and Group B, after. Calcium, Vitamin D, DEXA scans, FRAX scores, and refracture rates were measured.
Results: Mean age for group A and B were 79.0 and 74.9 years, respectively, and predominantly females. Serum calcium was higher in group B (9.51 mg/d/L versus 9.40 mg/dL) but not significant ($p = 0.19$). Fracture score among the groups was similar (20% versus 22%; $p = 0.44$). The total refracture rate for both vertebral and other fracture was significantly less in the post FLS patients, 36.5% versus 56% p-value = 0.01.
Conclusion: FLS program benefited patients with fragility fractures by decreasing the incidence of all refracture rates.

Background

Osteoporosis is a silent disease; however, its impact is not. Despite the serious clinical and social impact of fragility fractures, which are defined by the World Health Organization as a fracture caused by injury that would be insufficient to fracture a normal bone such as a fall from standing or no identifiable trauma, it is still underdiagnosed and undertreated.[1,2,3] Two million osteoporotic fractures are known to occur each year with a half million hospitalized in the United States.[4] There are 180,000 people placed in extended care facilities following a fragility fracture, with a resulting reduction in quality of life.[3] There are currently a great proportion of elderly, both men and women, with fragility fractures.[5] The leading mechanism of injury for the elderly are falls from standing height and minor trauma. Only a small portion of those patients (about 20%) will receive a bone mineral density test or receive osteoporosis treatment medication in the six-months following the fracture, with resulting high recurrent fracture rates (about 50%).[3]

Fragility fractures with underlying osteoporosis in patients over 50 remain one of the most demanding of resources on the health system, and with the world geriatric population rising fast, this problem will only worsen.[6]

Past research has dealt with osteoporosis and fragility fractures and made recommendations to address these concerns such as establishing a Fracture Liaison Service (FLS) program, however, these recommendations must make a difference in readmission and cost reduction.[6] Efforts have been made to halt and reduce the problem of refracture rates in osteoporotic patients by establishing the FLS program.[4] FLS programs are directed towards patient education and close follow-up at regular intervals with the aim of improving patient health and treating early, when needed.[7] The FLS program was implemented in certain institutions with success, yet

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wide use remains challenging. The main challenge is patient compliance since most of these patients are elderly with multiple medical problems and low mobility.[8]

In the neurosurgical clinic, the FLS program was implemented in 2015, as a care system to help ensure osteoporotic patients received a continuous and close follow-up to reduce the rate of recurrent fragility fractures. The goal of this study is to establish the benefit of FLS programs in reducing refracture rates.

Methods

Data were electronically extracted from two different time periods to determine the difference in refracture rates among the included participants (i.e. patients with fragility osteoporotic fracture). Fragility osteoporotic fractures include any fracture except those of the hands, feet and skull, in patients 50 years and older with no or minimal trauma. Participants were patients who presented to a local community hospital with a vertebral compression fracture who then followed up with the neurosurgery clinic. All patients included in this study had not received any prior standard treatment for osteoporosis or osteopenia before the initial fracture. Patient charts were reviewed to observe differences in refracture rates before and after recovering from vertebral augmentation (vertebroplasty or kyphoplasty) and before or after the implementation of the FLS clinic. The FLS program is run by an advance practice provider and supervised by a physician champion and consists of 24 months of follow up with patients, with the aim of reducing fragility refracture rates in osteoporotic patients. The initial visit consists of social and environmental questionnaires and thorough physical examination with basic laboratory tests including serum calcium and vitamin D levels as well as a (T-score) DEXA scan. Assessment of 10-year fracture risk score will be calculated followed by the plan of treatment which includes medication, vitamin D, and calcium supplements, social changes, physical therapy, and environmental support. The following six visits will be at regular intervals and focus on maintaining and affirming the above protocol. The compliance rate is 95%. This review included multiple visits by the patient to the clinic at regular intervals for clinical and laboratory assessment, and therapeutic treatment, if needed. The first time period (Pre FLS, Group A), were patients who presented between January 2012 and December 2014, which included 150 patients. The second time period (Post FLS, Group B), were patients who presented between January 2015 and December 2017, which included 215 patients. Demographic variables were obtained as well as various laboratory and test results for each patient.

The patients were analyzed according to age, sex, comorbid conditions (diabetes, cardiac, renal, vascular, and other medical conditions), serum calcium, serum Vitamin D levels, Dual-energy X-Ray absorptiometry (DEXA) scan, fracture (FRAX) score (calculated 10-year fracture risk), and refracture rate. The primary research question is whether the FLS program as implemented has reduced the refracture rates in this patient population. Statistical analyses were conducted between the two groups using student t-test and chi-square test, where appropriate. IRB approval was obtained for this study.

Results

In the study, 181 patients (84.2%) were enrolled in the FLS program during 2015 and 2016, while 34 patients (15.8%) were enrolled in 2017.

Table 1 shows selected demographics for both Group A and Group B. The mean age for Group A was 79.0 years (SD ± 11.56) and for those in Group B, the mean age was 74.9 years (SD ± 12.10). For both groups, most patients were female; Group A having 103 (69%) and Group B with 153 (71%). Group B consisted of more patients with four or more co-morbid conditions as opposed to Group A, 47(31%) patients and 86(40%) patients, respectively.

Table 1 presents laboratory and examination results which were measured at the first encounter with the patient. Variables which aid in understanding this risk include mean serum calcium which was 9.51 mg/dL in Group B versus 9.40 mg/dL in Group A ($p = 0.19$). Mean serum vitamin D between Group B and Group A was 38.03 ng/mL versus 35.79 ng/mL ($p = 0.75$), when looking at the pre FLS and post FLS group. Test results which were analyzed include the patients DEXA scan, and the FRAX score. The mean DEXA results were worse in Group B for both spine and femur density, but not statistically significant (−1.18 spine versus −0.52; $p = 0.09$ and −1.83 femur versus −1.69; $p = 0.50$). The mean FRAX score among Group B patients was similar to that of those in Group A (20% versus 22%; $p = 0.44$).

Table 2 shows the number of refractures among both groups by the type of refracture the patient sustained. The main finding was the post FLS group had less refractures for both vertebral and all other types of fracture. The rate of vertebral fractures went from 47(31%) in the pre FLS group down to 46(22%) and was not found to be significant (p-value = 0.29). All other types of fractures went from 37(25%) in the pre FLS group down to 32(15%) this was not a significant decrease (p-value = 0.32). The total rate of refracture between the two groups, regardless of the type, was found to be significant (p-value = 0.01).

Discussion

The American Association of Clinical Endocrinologists and

Table 1
Selected demographics, laboratory, and examination values for patients before and after the implementation of the FLS clinic.

	Pre (Group A)[a] (n = 150) n(SD)	Post (Group B)[b] (n = 215) n(SD)	p-value
Age(mean)	79.0(11.6)	74.9(12.1)	0.001
Sex	Male = 47 (31%) Female = 103 (69%)	Male = 62 (29%) Female = 153 (71%)	0.61
Co-morbid Conditions ≥ 4	47 (31%)	86 (40%)	0.91
Serum Calcium(mean)	9.40 mg/dL(.62)	9.51 mg/dL(.51)	0.19
Serum Vitamin D(mean)	35.79 ng/mL(17.6)	38.03 ng/mL(46.2)	0.75
DEXA Scan (t scores) (mean)	−0.52 spine(2.6) −1.69 femur(1.3)	−1.18 spine(1.8) −1.83 femur(1.2)	0.09 0.50
10-year Fracture Risk (FRAX Score)(mean)	22% major osteoporotic(14.5) 9% hip fracture(12.3)	20% major osteoporotic(12.1) 8% hip fracture(11.1)	0.44 0.85

[a] 2012–2014.
[b] 2015–2017.

Table 2
Number of refractures among patients before and after the implementation of the FLS clinic.

	Pre FLS/Post FLS (n, %)		
	Pre (Group A)[a] (n = 150)	Post (Group B)[b] (n = 215)	p-value
Fractures Vertebral	47 (31%)	46 (22%)	0.29
All Other (hip, ribs and extremities)	37 (25%)	32 (15%)	0.32
Total	84 (56%)	78 (37%)	0.01

[a] 2012–2014.
[b] 2015–2017.

College of Endocrinology in 2016, published a guideline for drug treatment of osteoporosis in post-menopausal women and stressed the fact that osteoporosis is a major public health problem impacting quality of life, that crosses the barriers of medical, social, and economic lines.[9]

In the United States, among women 55 years and older, the hospitalization burden of osteoporotic fractures and population facility-related hospital costs is greater than that of myocardial infarction, stroke and breast cancer combined.[3] Therefore, increased effort to reduce this burden is needed to control this upward trend, and bone health should be included in the care pathway for all patients who are 50 years and older.[6,10] The FLS program when implemented, will help reduce the burden of osteoporotic fractures.[6]

All 365 patients in group A and B with vertebral compression fractures went for vertebroplasty (either vertebral augmentation or kyphoplasty), since vertebroplasty provides pain relief and improved function with few side effects (4–5%).[11] Long-term efficacy has been a controversial issue,[12] however, per a study by Chen et al.,[11] only 23% had sustained subsequent fracture over a two-year period. In two recent randomized controlled studies, both procedures are efficacious compared to conservative management, including brace, pain medication, and observations.[11]

The mean age of the group was significantly higher in the pre-FLS group (79 years), as those patients were initially selectively referred for augmentation, while in the post-FLS group (74.9 years), we treated every patient who was diagnosed with a vertebral compression fracture ($p = 0.001$).

Female patients by far constitute the majority in this patient group as well as in other previous studies, as women above 50 with osteoporosis secondary to hormonal factors, encompasses two-thirds of those with fragility fractures.[1] Moreover, 50% of women older than 50 years will sustain osteoporotic fracture compared to 13% diagnosed with breast cancer in their lifetime.[1]

The neurosurgical clinic encounters a higher rate of comorbid conditions (4 or more) in the FLS program patients, 40% (Group B) compared to 31% in the pre FLS program patients (Group A), and although this is not statistically significant, it reflects the program's attention to the detail of patient medical and health history of those enrolled in the FLS program.

No significant differences were found between the two groups, in regard to serum calcium levels, Vitamin D levels, DEXA scans, and 10-year fracture risk (FRAX score) as detailed in Table 1. Patient DEXA scan results were not used to define the patient population as osteoporotic since the scan measures the cortical bone density only, which is an unreliable measurement of bone quality[2] (i.e. the cancellous and trabecular portions of the bone structure). Radiologic evidence of a vertebral compression fracture caused from the force of a fall of standing height or less in an individual over the age of 49 years of age is definitive evidence to support the diagnosis of osteoporosis, regardless of bone density scoring. Also, a more specific test, the Trabecular Bone Score (TBS) can be utilized to measure the cancellous bone quality. However, this is an expensive test and not readily available.

Refracture rates were higher in the pre-FLS group, which we attribute to the lack of structural follow-up and treatment by a healthcare provider. While refracture rates among the elderly patients in the post-FLS group was significantly lower (37% vs 56% p-value = 0.01), this is still an unacceptably high rate for such a preventable disease.

Our current FLS program was established in 2015 with a 95% compliance rate and with the eventual goal of significant reductions in fragility fractures among both males and females. The program currently involves patients with vertebral compression fractures, whether they receive augmentation or not. The program will be extended to all patients with fragility fractures including long bones and rib fractures.

Limitations

There were limitations in completing this study, the first being that 15.8% of the FLS patients were enrolled in 2017. Due to enrollment in 2017, these patients have not yet reached their full two-year follow-up which may affect the number of refractures. The second limitation is the small sample size. With a small number of patients being enrolled in the FLS program, it is difficult to show statistical significance in the refracture rates when measuring vertebral fractures versus rib, long bones, and pelvic fractures.

Conclusion

The fracture liaison service program, for follow-up and support of osteoporotic patients with fragility fractures, benefited the patients with vertebral compression fractures by decreasing the incidence of all refractures. There may be a role for such programs in preventing other fragility fractures in an effort to reduce the incidence of refracture rates.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amjsurg.2018.09.027.

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