Serum Levels of 25-Hydroxyvitamin D Following Acute Fracture in the Hospital Setting

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Introduction

Historically, the focus of treatment of patients admitted to hospitals and diagnosed with fragility fractures has been fracture management. Little if any attention has been paid to the risk factors that may have led to the fracture, treatment, or counseling that may reduce the risk of fracture in the future. Recently, the National Quality Forum (NQF) evaluated and endorsed performance measures designed to provide and report quality improvement guidelines in fragility fracture care. Our goal was to develop and implement a customized fragility fracture program in a large academic center to identify gaps in fracture care and then respond with modifications that would improve fracture care and minimize future fractures.

Methods

In 2011, a quality improvement team was created to address the current management of patients diagnosed with fragility fracture. The team included orthopedic residents, orthopedic, family and internal medicine faculty, and orthopedic nurse practitioners. The team developed a standard order set that was to be entered for every patient, over the age of 50, admitted with a fracture diagnosis. The order set included a metabolic profile, 25-hydroxyvitamin D level, TSH and PTH levels. A provision provided for both calcium (1000mg) and Vitamin D supplementation (1000 units). Additionally, a standard discharge plan was created for home discharge or inter-facility transfer. This included continued vitamin D and calcium supplement recommendations and a referral for a DEXA scan. Modifications have been re-instituted to the initiative during the two year implementation process. The current analysis includes patients from 2014 to assess compliance and effectiveness of the initiative to date. Charts from the months of June, July, October, November and December were reviewed and data was collected including demographics, fracture type, lab values and discharge instructions. Differences between males and females were testing using Student's t test or Chi-Square.

Results

Table 1: Fragility fracture order set initiative evaluation

Patients*	Age (mean+/-SD)	Fracture Order Set (number, %)	Order on D/C (number, %)	Replenishment Dose (mean+/- SD)	25(OH)D Levels (mean+/-SD)
Males (n = 61)	69.4 (14.0)+	33 54% ++	28 46% ++	796 IU (893) 5 pts. 50,000 IU	24.0 (13.2)
Females (n = 118)	79.6 (12.1)+	96 81% ++	88 75% ++	890 IU (407) 10 pts. 50,000 IU	24.8 (9.7)

*1 male patient death and 4 female deaths, not included in orders/vitamin D data

+ Males significantly younger by t test, $p < 0.01$

++ Significant differences in categorical variables by Chi-Square, $p < 0.01$

Results Continued

A total of 61 males and 118 females with fractures were identified. Fewer males had vitamin D testing: 33 or 54% of males and 96 or 81% of females had vitamin D levels ordered ($p = 0.01$). Few of the patients (33% of males and 16.1% of females) who had vitamin D levels measured had adequate levels. Significantly fewer males (28 or 46%) than females (88 or 75%) had discharge orders for follow-up ($p < 0.01$). While 100 (85%) of females were injured with falls, 33 (54%) of males were injured with falls, as compared with trauma and/or motor vehicle accidents (MVA). Fractures were the result of either trauma or a MVA 41% of the time in males and only 13% of the time in females. Males were significantly younger than females ($p < 0.01$).

Table 2: 25(OH)D levels and subsequent vitamin D replenishment

Patients	25(OH)D Levels (ng/mL)	Vitamin D Category*	% in category	Replenishment Dose 25(OH)D (patients and dose)
Females (n=118) Mean Age: 79.6 years 88 tested (81%)+	(10) < 12	Severe Deficiency	9.8%	(6) 1000 IU (1) 2000 IU (3) 50,000 IU
	(10) 12-20	Deficiency	14.8%	(7) 1000 IU (3) 50,000 IU
	(49) > 20-29	Insufficiency	41.5%	(41) 1000 IU (3) 2000 IU (3) 0 IU (2) 50,000 IU
	(19) ≥ 30	Adequate	16.1%	(18) 1000 (1) 0 IU
			25.6% no testing	
Males (n=61) Mean Age: 69.4 years 33 tested (54%)+	(6) < 12	Severe Deficiency	8.4%	(2) 1000 IU (1) 6000 IU (3) 50,000 IU
	(9) 12-20	Deficiency	8.4%	(8) 1000 IU (1) 50,000 IU
	(7) > 20-29	Insufficiency	11.5%	(6) 1000 IU (1) 50,000 IU
	(11) ≥ 30	Adequate	18.0%	(11) 1000 IU
			46 % no testing	

*Categories according to the Endocrine Society Clinical Practice Guidelines

+ Differences in categorical variables tested using Chi-Square, $p < 0.01$

Results Continued

Table 3: Fracture types and mechanism of injury

Patients	Fracture Types	Mechanism of Injury	Number of Patients	Percentage
Males	6 vertebral, 10 intertrochanteric, 4 femur, 3 rami, 4 tibia, 2 acetabulum, 2 humeral, 2 radial	Falls	33	54%*
	8 multiple, 1 intertrochanteric, 6 vertebral, 4 tibia, 1 acetabulum, 1 femur, 1 humeral, 3 radial	MVA/Trauma	25	41%*
	3 vertebral	Medical Illness	3	5%
Females	37 intertrochanteric, 13 vertebral, 11 femur, 11 rami, 10 humeral, 5 multiple, 10 radial, 3 acetabulum	Falls	100	85%*
	2 femur, 4 rami, 1 tibia, 2 vertebral, 3 intertrochanteric, 1 humeral, 1 radial, 1 acetabulum	MVA/Trauma	15	13%*
	1 femur, 1 intertrochanteric, 1 vertebral	Medical Illness	3	2%

*Significantly more females than males ($p< 0.01$) were injured by falls vs. trauma, Chi-Square

Conclusions

As of the end of 2014, in our hospital, a significant amount of patients 50 or older with an acute fracture did not undergo an osteoporosis work-up that included Vitamin D testing. We found that patients diagnosed with vertebral compression fractures were often overlooked perhaps due to the fact that they did not require an orthopaedic surgical intervention. When tested, at least 84% of patients had inadequate vitamin D levels. In addition, several patients with severe Vitamin D deficiency had inadequate treatment. This analysis demonstrates a need for a new provision in our fracture protocol that resolves this identified gap in fragility fracture care. We are currently in the process of developing a standing order set for Vitamin D replenishment soon to be implemented in our institution for fragility fracture patients.

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