

Fracture Healing Complications in Patients Presenting with High-Energy Trauma Fractures and Bone Health Intervention

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Purpose: Approximately 5%-10% of fractures will have healing complications of nonunion or malunion. Altered bone metabolism is one of many contributing factors to abnormal bone healing. Trauma patients may have many of the risk factors for osteoporosis which when combined with a high-impact injury can lead to poor fracture healing. The purpose of this study was to determine fracture healing complications following high-energy trauma in those who have had bone health follow-up.

Methods: From 2011 through 2012, 522 consecutive adults with high-energy trauma fractures received treatment in a Level I trauma center, were seen in an outpatient clinic for bone health, and retrospectively evaluated. 96 patients were excluded due to insufficient chart data, resulting in 426 patients in the study. Patients had a full workup consisting of mechanism of traumatic fracture(s), radiologic determination of healing, health and medication history, physical examination, bone health laboratory values drawn inpatient, and dual x-ray absorptiometry (DXA) outpatient when physically feasible. Vitamin D 50,000 IU was given following trauma presentation prior to initial laboratory draw and continued maintenance dose was dependent on laboratory results. Individualized bone health lifestyle behavioral counseling, treatment and prescription were provided as indicated. Both inpatient and outpatient electronic medical records were accessed to assess mechanism of trauma, medications, laboratory values, DXA scan values, open versus closed fracture, surgical intervention, and the occurrence of malunion or nonunion.

Results: There were 231 (54%) males and 195 (46%) females with a mean age of 54 years (range, 18-90), body mass index (BMI) of 27.7 kg/m² (range, 15.3-70.6), and predominance of Caucasians (405, 95%). Mechanism of injury was motor vehicle accident (MVA) (149, 35%), fall from height (106, 25%), motorcycle accident (MCA) (53, 12%), and other (118, 28%). 42/426 (10%) were open fractures. 19/426 (5%) had previous fracture(s) after age 50 years. Comorbidities included diabetes (45, 11%), hypothyroidism (45, 11%), chronic obstructive pulmonary disease (COPD) (23, 5%), and rheumatoid arthritis (RA) (17, 4%). 92/426 (22%) were smokers and 67 (16%) were past smokers. Medication history included bisphosphonate (10, 2%), PPIs (proton pump inhibitors) (64, 15%), estrogen (52, 12%), and glucocorticoids (7, 2%). Laboratory values included calcium 8.9 (range, 6.5-11.1), vitamin D 25 (OH) 27.5 (range, 3-65), with 262 (62%) less than 30 ng/mL. Bone turnover markers were: P1NP 52 (range, 1-231) and CTX 0.5 (range, 0.09-1.77). DXA T-score was -1.7 (range, 0.4 to -4.8). Decreased T-score was related to increased age ($r = -0.318$, $P < 0.001$). 34/426 (8%) and 6/426 (1.4%) resulted in nonunions and malunions, respectively. Nonunions occurred more frequently in open fractures (8/42 vs. 26/384, $P = 0.005$).

	Ca	Vitamin D	iPTH	CTX	P1NP	T-Score
Healed	8.9 (6.5-10.7)	27 (3-65)	51 (4-303)	0.5 (0.09-1.8)	52 (1-231)	-1.7 (0.4 to -4.8)
Nonunion	9.0 (8.0-11.1)	26 (14-42)	49 (15-104)	0.4 (0.2-0.9)	51 (9-164)	-1.6 (0.2 to -3.2)
Malunion	9.1 (8.0-10.1)	24 (14-32)	45 (18-85)	0.7 (0.5-1.0)	68 (28-187)	-1.7 (-0.7 to -2.9)

Conclusion: Despite presenting with high-energy trauma, initial bone metabolic laboratory values and DXA indicators were poor and did not vary between patients who healed their fractures and those with fracture-healing complications. Open fractures continue to be associated with nonunions. Vigilance in maximizing bone health in all patients may have been a contributing factor in keeping the nonunion and malunion rate relatively low.

- The FDA has not cleared this drug and/or medical device for the use described in this presentation (i.e., the drug or medical device is being discussed for an “off label” use). For full information, refer to page 600.