Association Of Serum Vitamin D Levels With Risks For Surgical Pediatric Fracture

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Introduction: There has been an increasing trend towards childhood vitamin D deficiency in developed countries. The National Health and Nutrition Examination Surveys (NHANES) found 1/3 of the US population has insufficient serum 25(OH)D based on Institute of Medicine (IOM) recommendations and suggests that all children be supplemented. Multiple articles in recent literature, suggest that vitamin D deficiency might be associated with fracture risk in children. A relationship between surgical fractures and low serum vitamin D 25(OH)D was seen in our preliminary study, suggesting that serum 25(OH)D testing may be especially useful in predicting outcomes and planning care in the pediatric fracture population.

This study sought to compare 25(OH)D levels of children with fractures to a control group and determine if 25(OH)D levels are associated with fractures or fracture severity and what the 25(OH)D fragility fracture threshold is within the fracture group.

Methods: This case control IRB approved study compared pediatric fracture patients to community controls with no comorbidities in a suburban New Jersey community. Lifestyle survey and data abstracted from the medical record were used. A total of 13 pediatric practices (45 pediatricians) contributed non-fracture controls. Univariate and multivariable ordinal regression analyses were performed. Fractures were placed into groups using the Abbreviated Injury Score (AIS). AIS scores get progressively worse starting at AIS 1. AIS 3 were fractures requiring surgery.

Results: Results: 369 fracture patients and 662 controls ≤ 18 years were included. Fracture and control groups’ 25(OH)D levels were not statistically different. Fracture group had mean 25(OH)D of 27.5 ± 8.9 vs 27.4 ± 9.1 in controls (p=0.914). However, among fracture patients, those with surgical fracture (AIS 3) had lower 25(OH)D levels (24.6) vs. nonsurgical fractures (AIS 1 & 2 with mean 30.0 and 28.3, respectively, p=0.001). The bone health survey found an association between increased outdoor play time and AIS fracture severity 3 (p=0.042). Adjusted odds ratios (OR) for Vitamin D levels on surgical fracture were calculated. Patients who had 25(OH)D <12 ng/mL were 20 times more likely to have a surgical fracture (OR 21.4, 95% CI 0.9-532, p=0.062). If 25(OH)D was <20ng/mL, the risk of surgical fracture was 3.5 times more likely (OR 3.5, 95% CI: 1.4-9.0, p=0.007). Patients who were <30ng/mL in 25(OH)D levels were twice as likely to have surgical fracture (OR 2.2, 95% CI: 1.0-4.7, p=0.059). Age, sex, and BMI were not found to be significant factors for AIS severity in this study.

Discussion: Clinical Relevance: While the occurrence of a pediatric fracture was not associated with 25(OH)D levels in this study, kids with deficient Vitamin D levels appear to be at risk for more severe fractures. Ideal target serum level for 25(OH)D should be at least 30ng/mL. Duration of outdoor play appears to be associated with more severe fracture risk. Future studies should investigate if this is due to increased exposure time to more at-risk activities while outdoors.
Significance: While the occurrence of a pediatric fracture does not appear to be directly associated with low VitD levels, this study shows a new critical fragility fracture threshold for serum level of VitD at 30ng/mL. Below this level there is an association with surgical pediatric fractures and potential for permanent disability.

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