Does 25-OH Vitamin D Deficiency Predispose Young Children to Multiple Fractures in the Setting of Minimal Trauma? A Preliminary Analysis

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BACKGROUND

- In the absence of significant accidental trauma, multiple fractures in a young child raises concern for physical abuse
- It has been hypothesized that there is an unrecognized "epidemic" of 25-OH Vitamin D insufficiency that produces findings frequently mistaken for child abuse
- This has been widely cited in legal cases involving suspected child abuse
- We aim to test the theory that 25-OH Vitamin D deficiency increases the risk for fracture in children

METHODS

- This study was approved by the IRB under a waiver of informed consent
- Participants were prospectively identified from a single level 1 pediatric trauma center who met CDPHE or NTDS trauma registry criteria
- Included criteria: < 5 years old and sufficient serum was obtained during the patient's clinical care
- 25-OH Vitamin D levels were obtained and clinical data was reviewed to determine the total number of fractures
- Exclusion criteria: previously diagnosed bone fragility disorder or inadequate serum available for 25-OH Vitamin D analysis

RESULTS

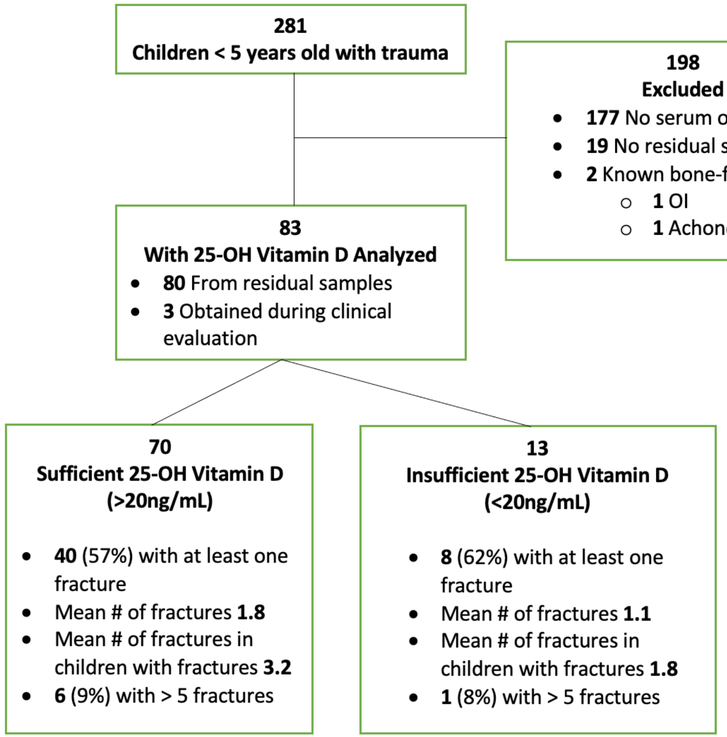

Figure 1: Subject inclusion with 25-OH vitamin D stratification

Table 1: Outcomes Stratified by 25-OH Vitamin D Status

	Vitamin D Sufficiency (>20 ng/mL) (n=70)	Vitamin D Insufficiency (<20 ng/mL) (n=13)	p
25-OH Vitamin D (ng/mL)			< 0.001
Median (IQR)	27.4 (25.4-31.7)	14.7 (11.5-16.7)	
Range	20.1 - 69.5	4.0 - 18.5	
At Least One Fracture	40 (57.1%)	8 (61.5%)	0.768
Number of Fractures			0.675
Mean (SD)	1.8 (3.7)	1.1 (1.8)	
Median (IQR)	1.0 (0.0-2.0)	1.0 (0.0-1.0)	
Range	0-24	0-7	
Number of Fractures (in those with fractures)			0.111
Mean (SD)	3.2 (4.4)	1.8 (2.1)	
Median (IQR)	1.0 (1.0-3.0)	1.0 (1.0-1.0)	
Healing Fractures	7 (10.0%)	0 (0.0%)	0.233
Non-CML Fracture (n)	113	14	

CML – Classic Metaphyseal Fracture

Table 2: Logistic regression for odds of fracture from vitamin D levels (ng/mL) and adjusting for age, sex, ISS scores and injury mechanism

	Univariate		Multivariate	
	OR	95% CI	aOR	95%CI
Vitamin D Insufficiency	1.23	(0.37, 4.43)	2.45	(0.46, 19.73)
ISS (Moderate vs. Minor)	2.36	(0.83, 7.04)	1.99	(0.54, 7.50)
ISS (Severe/Very Severe vs. Minor)	2.36	(0.67, 9.29)	1.85	(0.39, 9.23)
Severe Injury Mechanism	**3.40**	**(1.18, 11.42)**	**2.21**	**(0.46, 12.12)**
Age (Months)	0.99	(0.97, 1.02)	0.99	(0.96, 1.03)
Male	1.04	(0.43, 2.52)	1.20	(0.39, 3.82)
Trauma Mechanism: Fall	1.96	(0.76, 5.27)	2.58	(0.21, 37.78)
Trauma Mechanism: Non-Accidental Trauma	2.37	(0.72, 9.23)	**11.71**	**(1.60, 142.53)**
Trauma Mechanism: Motor-Vehicle	1.62	(0.51, 5.68)	3.74	(0.19, 82.21)
Trauma Mechanism: Animal	0.72	(0.15, 3.26)	2.03	(0.23, 26.17)
Trauma Mechanism: Burn/Unclear/Other	0.41	(0.15, 1.04)	0.79	(0.07, 9.26)

CONCLUSIONS AND LIMITATIONS

- Important to note this is only a preliminary study and significantly underpowered
- Data would seem to refute the hypothesis that 25-OH Vitamin D deficiency predisposes children to multiple fractures in the absence of significant trauma
- 25-OH Vitamin D insufficiency should not be offered as a reason to doubt the presence of physical abuse in a child with multiple, unexplained fractures
- This study is continuing to enroll subjects until a predetermined power criteria is met

* The authors of this study have no relevant disclosures to report