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Vitamin D insufficiency and radiologic bone findings in pediatric patients with severe acute kidney injury receiving prolonged continuous renal replacement therapy

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Background

- Patients requiring prolonged CRRT for >28 days (pCRRT) may be at risk for bone mineral disorders
- Pathological fractures have been reported in 2 adults receiving pCRRT with citrate anticoagulation
- The metabolic complications associated with pCRRT, including bone mineral disease have not been described in detail in children
- Starting at 30 days as part of standard of care, we follow serum vit D25-OH, vit D 1,25 di$(OH)_2$ and intact PTH, and bone xrays as feasible

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Objective

- We aimed to describe bone mineral status and radiologic bone findings in pediatric patients who required pCRRT

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Methods

- Our center utilizes continuous venovenous hemodiafiltration for CRRT with regional citrate anticoagulation per institutional protocol
- Calcium is infused postfilter to keep serum ionized calcium levels in the normal range
- All patients maintained on CRRT for >28 days during 2015-2017 were included in this analysis

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Demographics & characteristics n=37

Sex, m	55%
Median age in years at CRRT start	6 (1-13)
Age </=1yr at CRRT initiation	32%
Diagnosis	
Malignancy	38%
Liver failure/transplant	32%
Heart failure	14%
Primary sepsis	8%
Other diagnoses	8%
Median duration on CRRT, days (IQR)	43 (37-69)

Serum chemistries over time, mean values

Calcium, mg/dL	9.8 ± 1.3
Ionized Ca, mmol/L	1.2 ± 0.13
Phosphorus, mg/dL	4.3 ± 1.3
Vitamin D 25-OH ng/mL	24.6 ± 11.4
Vitamin D 1, 25 di(OH)2 ng/mL	36.2 ± 47.6
Intact PTH (pg/mL)	169 ± 233

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Results

- The prevalence of osteopenia and/or bone fractures during or following pCRRT was ~30%
- 21/34 (62%) of patients had persistently insufficient serum vit D-25 (<30 ng/mL) despite supplementation with vitamin D (enteral ergocalciferol, cholecalciferol or calcitriol)

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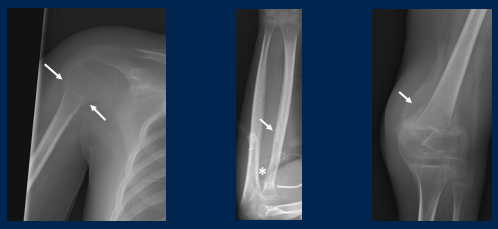
11yo, 12 wks CRRT; fractures R prox humerus, R radius (*pseudofracture), L distal femur



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9 mo, 7 wks CRRT; compressions deformities thoracolumbar vertebrae, impaction fracture R tibia, L femur fracture, diffuse osteopenia

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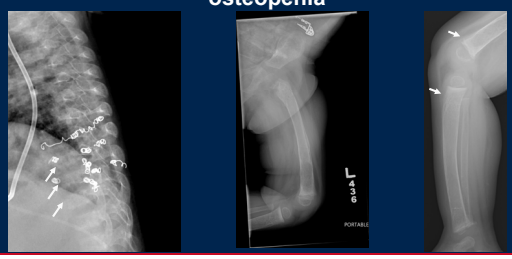
8 mo, 13 wks CRRT; 2 wks post-CRRT compression fractures thoracolumbar vertebrae, healing L femur/tibia, diffuse bone osteopenia



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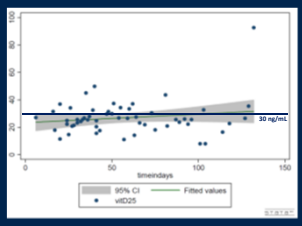
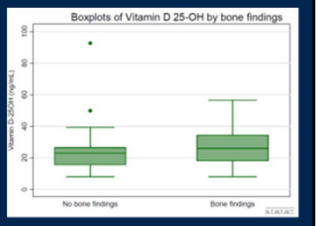
Results



Longitudinal serum vit D-25OH



Serum vit D-25OH not different in pts without & with bone findings

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Results cont'd

- Among patients with persistently low serum vit D-25OH levels, only 14% had bone findings compared to 62% among pts with serum levels > 30 ng/mL
- Patients with persistent serum vitamin D-25OH insufficiency (i.e., serum levels that were never >30 ng/mL) were less likely to have abnormal radiologic bone findings including fractures

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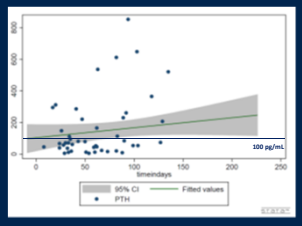
Results cont'd



Longitudinal serum intact PTH

Serum intact PTH not different in pts without & with bone findings

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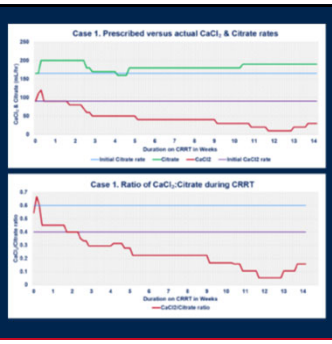
Diverging IV $CaCl_2$ and citrate infusion rates overtime in pCRRT



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Conclusion

- Osteopenia and bone fractures are prevalent among children who receive pCRRT
- Despite tight control of serum Ca and P levels, and vitamin D supplementation, ~2/3 of pts had persistent vitamin D insufficiency independent of iPTH levels
- It is unclear how much prolonged immobilization plays a role in the bone findings and whether prolonged citrate has untoward metabolic effects on bone in this setting
- Further studies should evaluate the mechanisms of bone mineral disease that may be responsible for bone disease in children on pCRRT, including role of immobilization, citrate, FGF23 and Klotho in this phenomenon

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THANK YOU!

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