Vitamin D supplementation in critically ill children: a prospective trial and dose evaluation
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Introduction
- Vitamin D3 is a prohormone produced in the skin following ultraviolet irradiation, which is converted to the active form (1,25-dihydroxyvitamin D3) via hydroxylation in the liver and kidney.
- Vitamin D deficiency is a common finding in the critically ill, though few clinical trials have studied the impact of vitamin D supplementation on clinical outcomes in the critically ill.
- Current studies are limited by vitamin D doses that failed to restore levels in vitamin D deficient patients.

Methods
- To analyze the effect of vitamin D supplementation in pediatric intensive care unit (PICU) patients and to determine the optimal dose in this population.

Objective
- To analyze the effect of vitamin D supplementation in PICU patients and to determine the optimal dose in this population.

Hypothesis
- The hypothesis is that supplementation with a sufficiently large dose of vitamin D will result in therapeutic vitamin D levels (>30 ng/mL), along with clinical benefits such as decreased PICU length of stay.

Methods, Continued
- **Intervention:**
  - Vitamin D3 Supplementation
    - Dose: 10000 IU/kg, max. = 400000 IU
    - Dosing schedule: weekly X 4 weeks, then monthly X 5 months (total of 6 months)
    - Formulation: oral cholecalciferol liquid

- **Outcomes:**
  - Primary outcome: therapeutic vitamin D level (>30 ng/mL)
  - Secondary outcome: PICU length of stay, readmission rates, growth, weight gain, number of emergency room (ER) visits, number of sick physician visits, missed school days, surrogate markers of inflammation (CRP, TNF-alpha, IL-6)

- **Stratification:**
  - Treatment and control groups will be stratified based on the presence of the following conditions:
    - Diabetes mellitus, cancer, cardiovascular diseases, upper respiratory tract illnesses, seizures, and premature infants.

- **Statistical analysis:**
  - Intention-to-treat, chi-square, student's t-test, ANCOVA

- **Plan for Analysis:**
  - Analysis of blood samples for 25-hydroxyvitamin D3 levels
  - Enzyme-linked immunosorbent assay (ELISA)
  - Quantification of TNF-alpha, IL-8, CRP, PTH, and calcium levels
  - Pharmacokinetic analysis
  - Serial sampling while patients are in the ICU

**Table 1. Inclusion and exclusion criteria**

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admitted to PICU</td>
<td>Supplementation with vitamin D in the six months preceding trial</td>
</tr>
<tr>
<td>Age &lt;18 years</td>
<td>Severe HF function</td>
</tr>
<tr>
<td>Presence of vascular access to obtain blood samples</td>
<td>Hypercalcemia (total calcium &gt;10.6 mg/dL or ionized serum calcium &gt;5.4 mg/dL)</td>
</tr>
<tr>
<td></td>
<td>Other trial participation</td>
</tr>
<tr>
<td></td>
<td>Neoplasms within the previous year</td>
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<tr>
<td></td>
<td>Hyperparathyroidism</td>
</tr>
</tbody>
</table>

**Table 2. Design scheme for data collection**

<table>
<thead>
<tr>
<th>Measures</th>
<th>Baseline</th>
<th>12-hours after dose</th>
<th>Daily in PICU</th>
<th>Month 1</th>
<th>Month 3</th>
<th>Month 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood samples</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
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<tr>
<td>(treatment group)</td>
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<tr>
<td>Blood samples</td>
<td>✗</td>
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<td>(control group)</td>
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<tr>
<td>Patient interviews</td>
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</tbody>
</table>

**References**

**Disclosures**
- Authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation.