**Vitamin D and Rickets**

**Vitamin D**

* **Prevalence of deficiency and insufficiency:** 15% of the pediatric population.
* **Vitamin D Physiology**

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* **Daily recommended intake(healthy individuals)**
	+ **I**nfants (soon after birth): 400 IU/day
	+ 1-18 years: 600IU/day
* **Definitions of sufficiency, insufficiency, and deficiency**
	+ Vitamin D sufficiency: 20 to 100 ng/mL
	+ Vitamin D insufficiency: 12 to 20 ng/mL
	+ Vitamin D deficiency: <12 ng/mL
* **Risk factors for deficiency**
	+ Nutritional deficiency: maternal Vit D deficiency, a diet deficiency, exclusive breastfeeding
	+ Malabsorption: celiac disease, inflammatory bowel disease, cystic fibrosis
	+ 25-hydroxylase deficiency: liver disease, genetic disease
	+ 1,25-hydroxylase deficiency: renal disease, genetic disease
	+ Increased metabolism of Vitamin D-use of anti-seizure meds, steroids
	+ Other: CYP34A deficiency, Vitamin D binding protein deficiency, and obesity
* **Clinical manifestations:**
	+ Rickets in growing children.
	+ Severe vitamin D deficiency may lower serum phosphorus levels--> muscle weakness.
* **Evaluation**:
	+ 25 hydroxyvitamin D levels in the high-risk population.
* **Treatment of mild vitamin D deficiency-cholecalciferol (D3) or ergocalciferol(D2)**
	+ <12 months old – 2000 IU/day for 6 to 12 weeks, followed by maintenance dosing of at least 400 IU/day for 3 to 6 months
	+ ≥12 months old – 2000 IU/day for 6 to 12 weeks, followed by maintenance dosing of 600 to 1000 IU/day for 3-6 months

**Rickets**

**Definition:** it refers to the changes at the growth plate caused by the deficient mineralization of bone before the closure of the growth plates.

1. **Calcipenic rickets**: phosphorus concentration is normal or low, along with elevated PTH levels.
2. **Phosphopenic rickets:** phosphorus level is low with normal PTH concentrations.
* **Evaluation**:
	+ Calcium, albumin, phosphorus, 25 hydroxyvitamin D levels, 1-25 dihydroxy vitamin D levels, PTH, spot urinary calcium/creatinine, alkaline phosphatase levels.
	+ Radiological: X-ray of wrists.

**Anticipatory Laboratory Values for different types of Rickets**

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| --- | --- | --- | --- | --- | --- | --- |
| **Parameters** | **Ca2** | **Po4** | **PTH** | **Alk Phos** | **25(OH) Vit D** | **1,25(OH2) Vit D** |
| **Vitamin D deficiency** | ↓/↔ | ↓/↔ | ↑ | ↑ | ↓ | ↔ |
| **1 alpha-hydroxylase def** | ↓ | ↓/↔ | ↑ | ↑ | ↔ | ↓ |
| **Vitamin D Resistant**  | ↓ | ↓/↔ | ↑ | ↑ | ↔ | ↑↑ |
| **Hypophosphatemic rickets** | ↔ | ↓↓ | ↔ | ↑ | ↔ | ↔ |

* **Treatment:** It depends on the type of Rickets.
	+ Chole/Ergocalciferol-10,000-60,000IU/day for Vitamin D deficiency rickets.
	+ Add calcium at a dose of 30-75mg/kg/day if hypocalcemia is present.
	+ Vitamin D resistant and 1 alpha-hydroxylase rickets are treated with calcitriol.
	+ For the treatment of hypophosphatemic rickets, calcitriol(higher dose) is given along with phosphorus supplementation.
	+ Monitoring requires monitoring of calcium, phosphorus, alkaline phosphatase, and parathyroid hormone levels in 2-3 weeks.

**References and Resources**

1. Munns CF, Shaw N, Kiely M, et al. Global Consensus Recommendations on Prevention and Management of Nutritional Rickets. J Clin Endocrinol Metab 2016; 101:394.