Guidelines for Management of Nutritional Vitamin D Deficiency in Children and Adolescents

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NOTE
This guideline is not intended to be construed or to serve as a standard of care. Standards of care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve. Adherence to guideline recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement must be made by the appropriate healthcare professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan. This judgement should only be arrived at following discussion of the options with the patient, covering the diagnostic and treatment choices available. It is advised, however, that significant departures from the national guideline or any local guidelines derived from it should be fully documented in the patient’s case notes at the time the relevant decision is taken.
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Purpose of Guideline

- Guidance for the management of Nutritional Vitamin D deficiency in children and young people under 16 years.

- The following guidelines are applicable for general use. Individual situations may require deviation from these guidelines.

- Who should use this document? Paediatricians, Paediatric Endocrinologists, Primary Care clinicians.

- Patients to whom this document applies.

- Children and young people under 16 years who have been referred to secondary care or have self-referred acutely.
**Definition of Rickets**

The diagnosis of rickets is made in the presence of raised alkaline phosphatase, together with classical X-ray changes along with clinical findings.

However, many children will not present with clinical features of rickets, but will be found to be vitamin D deficient in blood testing.

The suspicion of Vitamin D deficiency can often be found from the history of poor diet, inadequate sun exposure, and a raised alkaline phosphatase.

**Differential Diagnosis of Vitamin D deficiency**

**Commonest**

- Nutritional Vitamin D deficiency +/- Ca deficiency

**Consider**

- Malabsorption
- Phosphate Deficiency
- Liver Disease
- Renal Disease
- Anticonvulsant Therapy
- Hypophosphataemic Rickets
- Hypo and Pseudohypoparathyroidism
- Vitamin D Dependent Rickets (Types I & II)
- Renal Tubular Disorders
- Tumour-induced

(Vitamin D deficiency may be confused with skeletal dysplasia)
Clinical Assessment

History and examination
- Dietary history from birth
- Exposure to sunlight (child and mother)
- Use of drugs and multivitamins
- Motor Development
- Measure and accurately plot Height and weight
- Assess general nutritional status
- Look for classical signs of rickets

Investigations
- Left wrist X-Ray
- Serum urea, electrolytes, creatinine.
- Bone profile (Ca, Mg, Phosphate, Alkaline Phosphatase)
- Liver function tests
- Full blood count
- PTH
- 25 Hydroxy Vitamin D

Diagnosis
The classical biochemical picture of vitamin D deficiency is:
- Calcium – Normal or low
- Phosphate – Normal or low
- Alkaline phosphatase – Raised
- PTH – Normal or raised
- 25 Hydroxy cholecalciferol (25OHCC) – Low

Vitamin D serum concentrations
- Deficiency – Less than 30nmol/L
- Insufficiency – 30 to 50nmol/L
- Sufficiency – Above 50nmol/L
Treatment

It is important to treat with a combination of Vitamin D and calcium and then continue with maintenance therapy (see table).

Vitamin D (cholecalciferol or ergocalciferol)

- **Age less than 3 months - Give** 2000 units once daily. Calcium is not required due to an exclusive milk diet which has adequate calcium.
- **Age 3 to 6 months - Give** 2000 units once daily together with calcium.
- **Age 6 months to 12 years - Give** 3000-6400 units once daily together with calcium.

Once the initial Vitamin D course is complete, continue with maintenance vitamin D until the child has stopped growing.

- **Adolescents 12-18 years – Give** 6000 units once daily.

Once vitamin D course is complete - continue with maintenance treatment of vitamin D and calcium daily.

If there are compliance concerns

If compliance is an issue a single oral or intramuscular dose of 50 -300 000 units may be given every 3 months, with calcium (30mg/kg/day) for 12 weeks.

Large single doses of oral Vitamin D are generally not available in community pharmacies or district general hospitals.

Calcium therapy (may need to be adjusted according to response)

If the child is hypocalcaemic or they have a poor calcium diet, treatment should be for at least 4 weeks or longer if required – this should be assessed with dietician input.

Summary of Suggested Treatment of Vitamin D deficiency

<table>
<thead>
<tr>
<th>Age</th>
<th>Vitamin D (12 weeks)*</th>
<th>Calcium (4 weeks)**</th>
<th>Single Dose</th>
<th>Maintenance Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3 months</td>
<td>2000u/day</td>
<td>None</td>
<td>N/A</td>
<td>400 units</td>
</tr>
<tr>
<td>3 to 12 months</td>
<td>2000 to 2400u/day</td>
<td>500mg/day</td>
<td>50,000u</td>
<td>400 units</td>
</tr>
<tr>
<td>1 to 12 years</td>
<td>3000 to 6400u/day</td>
<td>500mg to 1000mg/day</td>
<td>150,000u</td>
<td>600 units</td>
</tr>
<tr>
<td>Over 12 years</td>
<td>6000 to 6400u/day</td>
<td>1000mg to 1500mg/day</td>
<td>300,000u</td>
<td>600 to 800 units</td>
</tr>
</tbody>
</table>

* Range of doses given are to allow for the use of liquid and solid dose forms. Round up or down the dose as appropriate.

** Only use calcium if the child is hypocalcaemic.
Follow up

12 weeks after start of treatment

- Check - Serum U&E’s, Calcium, Phosphate, Alkaline Phosphatase, PTH.
- Ensure dietetic review was done.
- Expect improvement in biochemistry and motor milestones.
- Reduce Vitamin D dose to maintenance (as multivitamins or combined with Calcium (see combination products).
- Expect improvements in x-ray appearance.
- Discharge to GP on Vitamin D supplement – to continue until at least the age of 5yrs, preferably until the child stops growing.

Consider alternative diagnoses and referral to Metabolic Bone Clinic or endocrine clinic.

Remember

- In young infants and older adolescents, the classic findings of rickets (X-Ray changes and deformities) may be absent despite profound Vitamin D deficiency.
- Other siblings and parents, especially, mother may also be Vitamin D deficient and vitamin D supplementation (400 units/600 units) may be beneficial for the whole family.
- Iron deficiency anaemia often accompanies Vitamin D deficiency.
Available preparations for Treatment

Available Vitamin D preparations

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Form</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abidec (multivitamins)</td>
<td>liquid</td>
<td>400u/0.6ml</td>
</tr>
<tr>
<td>Dalivit (multivitamins)</td>
<td>liquid</td>
<td>400u/0.6ml</td>
</tr>
<tr>
<td>Desunin</td>
<td>tablet</td>
<td>800u</td>
</tr>
<tr>
<td>Fultium D3</td>
<td>capsule</td>
<td>800u</td>
</tr>
<tr>
<td>Fultium D3*</td>
<td>drops</td>
<td>2,740u/ml (200u = 3drops)</td>
</tr>
<tr>
<td>Invita D3*</td>
<td>drops</td>
<td>2,400u/ml (67u = 1drop)</td>
</tr>
<tr>
<td>Thorens*</td>
<td>liquid</td>
<td>10,000u/ml</td>
</tr>
<tr>
<td>Invita D3*</td>
<td>liquid</td>
<td>25,000u/ml</td>
</tr>
<tr>
<td>Fultium D3</td>
<td>capsule</td>
<td>20,000u</td>
</tr>
</tbody>
</table>

*In infants, children and adolescents Fultium-D3 Drops, Invita D3 drops/liquid, and Thorens liquid can be mixed with a small amount of children's foods, yogurt, milk, cheese or other dairy products. The drops/liquid must not be mixed into a bottle of milk or container of soft foods in case the child does not consume the whole portion, and consequently does not receive the full dose. Also it can be mixed with a spoonful or a small amount of cold or lukewarm food immediately prior to use.

Calcium preparations available

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Form</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alliance calcium</td>
<td>Liquid</td>
<td>2.50 mmol calcium/5ml</td>
</tr>
<tr>
<td>Cacit</td>
<td>effervescent tablets</td>
<td>500mg/12.5mmol calcium per tablet</td>
</tr>
<tr>
<td>Sandocal 1000</td>
<td>effervescent tablets</td>
<td>100mg/25mmol calcium per tablet</td>
</tr>
</tbody>
</table>

Combination products available (for maintenance treatment if still hypocalcaemic or on a low calcium in diet)

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Form</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accrete D3</td>
<td>Tablet</td>
<td>calcium 600mg and vitamin D 400iu</td>
</tr>
<tr>
<td>TheiCal D3</td>
<td>Chewable tablet</td>
<td>calcium 1000mg and vitamin D 880iu</td>
</tr>
</tbody>
</table>
References
