

Scottish Paediatric Endocrine Group

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

NOTE

This guideline is not intended to be construed or to serve as a standard of care. Standards of care are determined based on 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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Management of Nutritional Vitamin D Deficiency in Children and Adolescents

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Management of Nutritional Vitamin D Deficiency in Children and Adolescents

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)

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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 in children <3 years old, knee X-ray in children >3 years old.
- 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

The following guidance is for children with vitamin D deficiency (serum vitamin D <

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30 nmol/L). Those insufficient in vitamin D (serum vitamin D 30-50 nmol/L) should be advised to take an over-the-counter vitamin D supplement appropriate for their age or as per the maintenance doses in the table below.

Treatment for children with vitamin D deficiency (<30nmol/L)

Treatment dose vitamin D is given initially (with calcium if required). Following treatment course, maintenance vitamin D dose should be recommended.

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 if required.
- **Age 6 months to 12 years - Give** 3000-6400 units once daily together with calcium if required.

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.

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, has a low phosphate or an elevated alkaline phosphatase or they have a poor calcium containing diet (assessed by dietician), treatment should be for at least 4 weeks or longer if required.

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Summary of Suggested Treatment of Vitamin D deficiency

Age	TREATMENT DOSES			MAINTENANCE
	Vitamin D treatment dose (12 weeks)*	Calcium if required (4 weeks)**	Alternative single high dose treatment vitamin D (oral/IM)	Vitamin D maintenance (over-the-counter)
< 3 months	2000u/day	None	N/A	400 units
3 to 12 months	2000 to 2400u/day	500mg/day	50,000u	400 units
1 to 12 years	3000 to 6400u/day	500mg to 1000mg/day	150,000u	600 units
Over 12 years	6000 to 6400u/day	1000mg to 1500mg/day	300,000u	600 to 800 units

* 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 give calcium if the child has low calcium or phosphate, elevated alkaline phosphatase or low calcium containing diet.

Follow up

12 weeks after start of treatment

- Check - Serum U&E's, Calcium, Phosphate, Alkaline Phosphatase, PTH.
- Ensure dietetic review carried out
- 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.

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Remember

- In young infants and older adolescents, the classic findings of rickets (x-ray changes and bony 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

Preparation	Form	Concentration
Abidec (multivitamins)	liquid	400u/0.6ml
Dalivit (multivitamins)	liquid	400u/0.6ml
Desunin	tablet	800u
Fultium D3	capsule	800u
Fultium D3*	drops	2,740u/ml (200u = 3drops)
Invita D3*	drops	2,400u/ml (67u = 1drop)
Thorens*	liquid	10,000u/ml
Invita D3*	liquid	25,000u/ml
Fultium D3	capsule	20,000u
Stexerol	tablet	25000u

*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.

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Calcium preparations available

Preparation	Form	Concentration
Calvive 1000 (calcium carbonate 1.75g, calcium lactate gluconate 2.263g)	Effervescent tablets	Equivalent to 1000mg calcium
Calcium 500mg effervescent tablets (calcium carbonate 1.25g)	Effervescent tablets	Equivalent to 500mg calcium

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

Preparation	Form	Concentration
Adcal D3 dissolve	Effervescent tablet	Calcium 600mg and vitamin D 400iu
Accrete D3 One a Day	Chewable tablet	Calcium 1000mg and vitamin D 880iu

References

1. Global Consensus Recommendations on Prevention and Management of Nutritional Rickets Horm Red Paediatr Jan 2016
2. Vitamin D and bone health: a practical clinical guideline for management in children and young people. Paul Arundel and Nick Shaw. National Osteoporosis Society June 2015