Whittington Health NHS

Rickets due to vitamin D deficiency

Subject:	Rickets due to vitamin D deficiency
Policy Number	N/A
Ratified By:	Clinical Guidelines Committee
Date Ratified:	Original approved March 2009 Reviewed with minor change August 2011 Reviewed with minor change July 2014 Minor addition September 2015
Version:	4.0
Policy Executive Owner:	WCF Divisional Director
Designation of Author:	Consultant Paediatrician, Dr J Raine Review: Dr P Kalaivanan
Name of Assurance Committee:	As above
Date re-issued:	September 2015
Review Date:	September 2018 (3 years hence)
Target Audience:	All Paediatric Clinical Staff
Key Words:	Rickets, children, vitamin D deficiency, nutritional rickets, calcium, hypocalcaemia

Version Control Sheet

Version	Date	Author	Status	Comment
3.0	July 2014	Dr J Raine Dr P Kalaivanan	Live	Reviewed in accordance with generic paediatric guideline review: two changes. 1. Injections Ergocalciferol□• (300 000 units)/mL in oil **(To be inserted in page 5 after tablets section)** 2. Patients with rickets require close follow-up to document normalization of serum 25(OH)D, PTH, calcium and phosphorus levels, and long-term maintenance of vitamin D sufficiency. Recovery is associated with an initial increase in serum phosphate and alkaline phosphatase (ALP), followed by a gradual normalization of ALP and 25(OH)D levels. **(To be inserted after follow up heading)**
4.0	Sept 2015	Dr J Raine		Minor additions to ***Severe symptomatic hypocalcaemia*** **paragraph**

➢ Criteria for use

Inclusion criteria:

- 3 months -18 years
- Nutritional (Vitamin D deficiency) Rickets

Exclusion criteria:

- Rickets of prematurity
- Hepatic or renal dysfunction
- Malabsorption
- Enzyme deficiency / end organ resistance to vitamin D

➢ Background/ introduction

There has been a resurgence of vitamin D deficiency and consequent rickets in many parts of North America and Europe including the UK. This is especially the case in dark skinned individuals and ethnic minority populations.

The Whittington catchment area has a sizeable population of ethnic minority communities.

Sources of Vitamin D

- Ultraviolet B sunlight exposure: > 90% of vitamin D is derived from UV light
- Oily fish (trout, salmon, mackerel, herring, sardines, anchovies, pilchards, fresh tuna)
- Cod liver oil and other fish oils
- Egg yolk
- Mushrooms
- Supplemented breakfast cereals
- Margarine and infant formula milk

The recommended daily intake of Vitamin D in the UK is 400 IU (10mcg) per day for an adult and 280 IU (7mcg) for children between 6 months and 3 years and 340 IU (8.5mcg) per day for infants under 6 months. However, these recommendations only provide sufficient vitamin D to prevent rickets and osteomalacia, and such an intake alone, in the absence of skin synthesis, will not provide an optimal vitamin D status.

➢ Clinical presentation

Nutritional rickets can manifest one or more of the following clinical features:

- Not wanting to weight bear/ delayed walking
- Generalised aches & pains / weakness
- Skeletal deformities
- Convulsions
- Stridor
- Fracture
- Dilated cardiomyopathy

Occasionally, children may be asymptomatic and the diagnosis may be made incidentally on bone biochemistry or on screening of family members.

Biochemical features:

- Low - normal Calcium (Ca)
- Low Phosphate (PO_4)
- High Alkaline Phosphatase (ALP)

➢ Clinical management

History and examination:

- Take a dietary history. All cases should be referred to a dietician
- Thorough clinical examination

Investigations:

Baseline bone biochemistry

- Corrected Ca
- PO_4,
- ALP
- Parathyroid hormone
- Vitamin D – lab measures serum 25 $(OH)D_{2\&3}$
- Urea & creatinine; Liver function tests (LFTs), Coeliac screen (IgA/transglutaminase)

Wrist X-ray - (cupping, fraying and splaying of the metaphysis and may have a periosteal reaction along the shaft)

There is often a concomittant iron deficiency and a full blood count, ferritin +/- a haemoglobinopathy screen should also be performed.

If there is any doubt about the interpretation of the results, discuss with the relevant consultant

Table 1: Serum 25-OHD concentrations, health and disease

Serum 25-OHD concentration	Vitamin D status	Manifestation	Management
<25nmol/l	Deficient	Rickets Osteomalacia	Treat High dose Calciferol
25-50nmol/l	Insufficient	Associated with disease risk	Vit D Supplementation
50-75nmol/l	Adequate	Healthy	Lifestyle advice
>75nmol/l	Optimal	Healthy	None

Treatment:

Vitamin D

Deficiency (25-OHD <25nmol/l)

Under 6 months: 3000 IU Calciferol daily for 8-12 weeks
Over 6 months: 6000 IU Calciferol daily for 8 -12 weeks

Insufficiency: (25-OHD 25-50nmol/l)

Under 6 months: 200-400 IU Calciferol daily
Over 6 months: 400-800 IU Calciferol daily

(to convert IU to mcg of Calciferol, divide by 40)

Preparations of Calciferol available in the UK

Solution and drops

- Dalivit (LPC Pharmaceuticals, Luton, Bedfordshire)
  - Multiviatmin preparation containing colecalciferol 400 IU per 0.6ml
- Abidec (Chefaro UK, Huntingdon, Cambridgeshire)
  - Multivitamin preparation containing colecalciferol 400 IU per 0.6ml
- Healthy start vitamin drops
  - Multivitamin preparation containing colecalciferol 300 IU per 5 drops
- Ergocalciferol oily solution
  - 3000 IU/ml

Tablets and Capsules

- Calcium and Vitamin D (400mg calcium and 400 IU ergocalciferol), Adcal-D3, Cacit D3, Calcichew D3 etc
- Colecalciferol 20, 000 IU(Dekristol; MIBE, Germany)
- Ergocalciferol 10,000 IU or 50, 000 IU (UCB Pharma, Slough, Berkshire)

Injections

- Ergocalciferol (300 000 units)/mL in oil

NB: Compliance with long term vitamin D supplementation may be poor. A one off high dose oral or intramuscular therapy may be an effective option if compliance is suspect. Discuss with consultant.

(Breastfed infants from 6 months (or from 1 month if there is any doubt about the mother's vitamin status during pregnancy) and formula fed infants who are over 6 months and taking less than 500 ml infant formula per day should be on healthy start children's vitamin drops. The recommended dose of 5 drops contains 7.5 mcg of vitamin D3 which is equivalent to 300 units. The drops also contain vitamins C and A. The vitamins should be continued till 5 years of age.)

Follow up

If Calcium normal: repeat bone and vitamin D level at 3 months and review in clinic
If calcium low: blood tests may need to be repeated more often. Eg: 1 or 2 weeks following start of treatment depending on calcium level, 6 weeks, 3 months (see table below).
If there is hypocalcaemia or there are issues with compliance close outpatient follow-up will be required.

Hypocalcaemia

Severe symptomatic hypocalcaemia eg seizures and tetany:

Severe symptomatic hypocalcaemia in children aged 1 month to 18 years, should be treated with intravenous calcium gluconate 10% over 5 to 10 minutes (Dose: 0.11mmol/kg = 0.5mls/kg of 10% calcium gluconate; max 4.5mmol= 20mls of 10% calcium gluconate). A continuous infusion may be required and if so, should ideally be administered via a central venous line as calcium is irritant to peripheral veins and there is a risk of extravasation. Higher dose can sometimes be used but discuss first with the Endocrinology team at Great Ormond Street Hospital. Please see cBNF for dose for a neonate.

Mild asymptomatic hypocalaemia:

Mild asymptomatic hypocalcaemia should be managed with oral calcium supplements. Treat if calcium below normal range.

Age	Dose
1 month – 4 years	**0.25mmol/kg qds**
5-12 years	**0.2mmol/kg qds**
12-18 years	**10mmol qds**
Doses should be adjusted to response	

Iron

If ferritin <15 (normal range 15-200 nmol/L) treat with Sytron (sodium feredetate, equivalent to 27.5mg of iron / 5mls) for 3 months.

Age	Dose
1 month – 1 year	**2.5ml bd**
1-5 years	**2.5ml tds**
5-12 years	**5mls tds**
12-18 years	**5-10mls tds**

Consideration should be given to screening siblings for rickets and anaemia as they may also be affected. Parents may also be vitamin D deficient. As a minimum a maintenance dose of vitamin D is recommended for other family members.

(All pregnant women and mothers of infants less than 1 year old should be on vitamin supplements. One should consider referring mothers of children with rickets to their GP for bone chemistry and vitamin D levels and to investigate for possible anaemia.)

Follow up – what and when to monitor:

Patients with rickets require close follow-up to document normalization of serum 25(OH)D, PTH, calcium and phosphorus levels, and long-term maintenance of vitamin D sufficiency. Recovery is associated with an initial increase in serum phosphate and alkaline phosphatase (ALP), followed by a gradual normalization of ALP and 25(OH)D levels.

If Ca significantly low eg <1.80mmol/L	**-**	**Bone profile weekly, until Ca normalised,** **Adjust Ca dose as needed (bone profile may be required every few days if calcium very low or if there are concerns regarding compliance)**
At 2 weeks	**-**	**Bone profile**
At 6 weeks	**-**	**Bone profile**
At 3 months	**-**	**Bone profile, Vit D, clinic follow up**

Stop calcium supplements once serum calcium is normal

If ALP normal at 3 months, commence Vitamin D at 400 I.U./day indefinitely (review at 18 years), e.g. Dalivit 0.6ml once daily

➢ Reference

Diagnosis and management of Vitamin D deficiency, Pearce SH, Cheetham TD, BMJ 2010 Jan 11:340:b5664

➢ Contacts

Out of hours:

Paediatric registrar (bleep 3111)
Consultant paediatrician on call (via switch)

To be completed and attached to any procedural document when submitted to the appropriate committee for consideration and approval

		Yes/No	Comments
1.	**Does the procedural document affect one group less or more favourably than another on the basis of:**		
	• Race	No	
	• Ethnic origins (including gypsies and travellers)	No	
	• Nationality	No	
	• Gender	No	
	• Culture	No	
	• Religion or belief	No	
	• Sexual orientation including lesbian, gay and bisexual people	No	
	• Age	No	
	• Disability - learning disabilities, physical disability, sensory impairment and mental health problems	No	
2.	**Is there any evidence that some groups are affected differently?**	No	
3.	**If you have identified potential discrimination, are any exceptions valid, legal and/or justifiable?**	No	
4.	**Is the impact of the procedural document likely to be negative?**	No	
5.	**If so can the impact be avoided?**	N/A	
6.	**What alternatives are there to achieving the procedural document without the impact?**	N/A	
7.	**Can we reduce the impact by taking different action?**	N/A	

If you have identified a potential discriminatory impact of this procedural document, please refer it to the Director of Human Resources, together with any suggestions as to the action required to avoid/reduce this impact.

For advice in respect of answering the above questions, please contact the Director of Human

Resources.

Checklist for the Review and Approval of Procedural Document

To be completed and attached to any procedural document when submitted to the relevant committee for consideration and approval.

	Title of document being reviewed:	Yes/No	Comments
1.	**Title**		
	Is the title clear and unambiguous?	Yes	
	Is it clear whether the document is a guideline, policy, protocol or standard?	Yes	
2.	**Rationale**		
	Are reasons for development of the document stated?	Yes	
3.	**Development Process**		
	Is it clear that the relevant people/groups have been involved in the development of the document?	Yes	
	Are people involved in the development?	Yes	
	Is there evidence of consultation with stakeholders and users?	Yes	
4.	**Content**		
	Is the objective of the document clear?	Yes	
	Is the target population clear and unambiguous?	Yes	
	Are the intended outcomes described?	Yes	
5.	**Evidence Base**		
	Are key references cited in full?	N/A	
	Are supporting documents referenced?	N/A	
6.	**Approval**		
	Does the document identify which committee/ group will approve it?	Yes	
7.	**Dissemination and Implementation**		
	Is there an outline/plan to identify how this will be done?	Yes	
8.	**Document Control**		
	Does the document identify where it will be held?	Yes	
9.	**Process to Monitor Compliance and Effectiveness**		
	Are there measurable standards or KPIs to	Yes	

	ment being reviewed:	Yes/No	Comments
	support the monitoring of compliance with and effectiveness of the document?		
	Is there a plan to review or audit compliance with the document?	Yes	
10.	**Review Date**		
	Is the review date identified?	Yes	
	Is the frequency of review identified? If so is it acceptable?	Yes	
11.	**Overall Responsibility for the Document**		
	Is it clear who will be responsible for co-ordinating the dissemination, implementation and review of the document?	Yes	

Executive Sponsor Approval			
If you approve the document, please sign and date it and forward to the author. Procedural documents will not be forwarded for ratification without Executive Sponsor Approval			
Name		Date	
Signature			
Relevant Committee Approval			
The Director of Nursing and Patient Experience's signature below confirms that this procedural document was ratified by the appropriate Governance Committee.			
Name		Date	
Signature			
Responsible Committee Approval – only applies to reviewed procedural documents with minor changes			
The Committee Chair's signature below confirms that this procedural document was ratified by the responsible Committee			
Name		Date	
Name of Committee		Name & role of Committee Chair	
Signature			

Tool to Develop Monitoring Arrangements for Policies and guidelines

What key element(s) need(s) monitoring as per local approved policy or guidance?	Who will lead on this aspect of monitoring? Name the lead and what is the role of the multidisciplinary team or others if any.	What tool will be used to monitor/check/observe/Assess/inspect/ authenticate that everything is working according to this key element from the approved policy?	How often is the need to monitor each element? How often is the need complete a report ? How often is the need to share the report?	What committee will the completed report go to?
Element to be monitored	**Lead**	**Tool**	**Frequency**	**Reporting arrangements**
General adherence to guideline	Dr Raine	Clinical audit	On review of the guideline – every 3 years	Paediatric meetings