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A clinical dilemma in the detection of paediatric hypophosphataemia

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Background

- The clinical interpretation of plasma or serum phosphate concentrations depends, to a certain extent, on the age- and gender-specific reference intervals applicable to the laboratory methods employed.
- Harmonised phosphate reference intervals based on consensus have been published by professional groups.
- Large-scale prospective studies have also established paediatric reference intervals for many analytes by recruiting healthy young people and using the direct method for establishing reference intervals.

Methodology

- A literature search was conducted to identify:

(1) prospective, a priori studies for the establishment of paediatric reference intervals;
(2) published consensus paediatric phosphate reference intervals.

Results & Discussion

- Two sources of harmonised paediatric phosphate reference intervals based on consensus among healthcare professionals have been identified, i.e. the Australasian Association of Clinical Biochemists (AACB) and the Pathology Harmony Group (United Kingdom).

- There are four separate well-designed, large-scale prospective studies for the direct establishment of paediatric reference intervals for plasma/serum phosphate concentrations.

- The consensus reference intervals for paediatric phosphate concentrations from the AACB and the Pathology Harmony Group are partitioned according to age but not gender.

- The Pathology Harmony Group currently recommends a single age partition for plasma and serum phosphate concentrations in both genders from 1 to 16 years of age.

- From birth up to 13 years of age, all consensus lower reference limits (LRLs) for phosphate recommended by the AACB and the Pathology Harmony Group are numerically lower than the corresponding LRLs established using direct methods in the above four prospective studies.

- The harmonised paediatric phosphate LRLs based on consensus and published by the AACB and the Pathology Harmony Group may lack diagnostic sensitivity in detecting mild to moderate hypophosphataemia especially in young children.

Lower reference limits (LRLs) for plasma/serum phosphate (mmol/L) in girls

Age group	LRLs from harmonised reference intervals		LRLs established using direct methods in prospective studies			
	AACB	Pathology Harmony Group (UK)	Colantonio et al. 2012 (CALIPER Study)	Ridefelt et al, 2012 (Falun Study)	Hislted et al. 2013 (Copenhagen Puberty Study)	Adeli et al. 2015 (CHMS Study)
			Abbott Architect	Abbott Architect	Roche Modular P	Ortho Vitros
0d to <7d	1.25	1.30	1.80			
7d to <15d	1.50	1.30	1.80			
15d to <1m	1.50	1.30	1.54			
1m to <6m	1.45	1.30	1.54			
6m to <1yr	1.30	1.30	1.54	1.64		
1yr	1.10	0.90	1.38	1.35		
2yr	1.10	0.90	1.38	1.35		
3yr	1.10	0.90	1.38	1.35		1.42
4yr	0.90	0.90	1.38	1.35		1.42
5yr	0.90	0.90	1.33	1.35	1.19	1.42
6yr	0.90	0.90	1.33	1.35	1.19	1.42
7yr	0.90	0.90	1.33	1.35	1.10	1.42
8yr	0.90	0.90	1.33	1.11	1.10	1.42
9yr	0.90	0.90	1.33	1.11	1.10	1.42
10yr	0.90	0.90	1.33	1.11	1.10	1.42
11yr	0.90	0.90	1.33	1.11	1.06	1.16
12yr	0.90	0.90	1.33	1.11	1.06	1.16
13yr	0.90	0.90	1.02	0.94	1.06	1.16
14yr	0.90	0.90	1.02	0.94	0.72	1.16
15yr	0.80	0.90	1.02	0.94	0.72	1.16
16yr	0.80	0.90	0.95	0.94	0.72	0.94
17yr	0.80	0.80	0.95	0.94	0.72	0.94

Lower reference limits (LRLs) for plasma/serum phosphate (mmol/L) in boys

Age group	LRLs from harmonised reference intervals		LRLs established using direct methods in prospective studies			
	AACB	Pathology Harmony Group (UK)	Colantonio et al. 2012 (CALIPER Study)	Ridefelt et al, 2012 (Falun Study)	Hislted et al. 2013 (Copenhagen Puberty Study)	Adeli et al. 2015 (CHMS Study)
			Abbott Architect	Abbott Architect	Roche Modular P	Ortho Vitros
0d to <7d	1.25	1.30	1.80			
7d to <15d	1.50	1.30	1.80			
15d to <1m	1.50	1.30	1.54			
1m to <6m	1.45	1.30	1.54			
6m to <1yr	1.30	1.30	1.54	1.64		
1yr	1.10	0.90	1.38	1.35		
2yr	1.10	0.90	1.38	1.35		
3yr	1.10	0.90	1.38	1.35		1.42
4yr	0.90	0.90	1.38	1.35		1.42
5yr	0.90	0.90	1.33	1.35	1.03	1.42
6yr	0.90	0.90	1.33	1.35	1.03	1.42
7yr	0.90	0.90	1.33	1.35	1.21	1.42
8yr	0.90	0.90	1.33	1.28	1.21	1.42
9yr	0.90	0.90	1.33	1.28	1.05	1.42
10yr	0.90	0.90	1.33	1.28	1.05	1.42
11yr	0.90	0.90	1.33	1.28	1.06	1.23
12yr	0.90	0.90	1.33	1.28	1.06	1.23
13yr	0.90	0.90	1.14	0.94	1.06	1.23
14yr	0.90	0.90	1.14	0.94	0.81	1.23
15yr	0.80	0.90	1.14	0.94	0.81	1.23
16yr	0.80	0.90	0.95	0.94	0.81	0.94
17yr	0.80	0.80	0.95	0.94	0.90	0.94

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