

The Phosphate Conundrum-spurious or iatrogenic?

Transient hyperphosphatemia and hyperparathyroidism in a preterm neonate

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Introduction

We report the case of a preterm neonate who developed a transient hyperphosphatemia at 1 month of age with associated hyperuremia, hypercreatininemia and hyperparathyroidism. She was asymptomatic.

Case Report

This baby girl was born by emergency Caesarean section for maternal APH at 27+6 weeks and weighed 1180g. She had an uneventful neonatal period with minimal ventilation. She was treated with **ibuprofen**, **amiloride** and **furosemide** for a PDA (Patent ductus arteriosus) with associated heart failure. Her enteral feeds had been increased and fortified due to poor weight gain. Her other medications include caffeine citrate, erythromycin, ranitidine, sodium chloride supplements and vitamins. At 1 month of age, she developed hyperphosphatemia (phosphate 3.93 mmol/L) with associated hyperuremia (urea 14.3 mmol/L) and hypercreatininemia (creatinine 58 $\mu\text{mol/L}$). Potassium remained on the higher end of normal (5.1 mmol/L) and sodium was stable on supplements (134 mmol/L). The parathormone level was 33pmol/L(1.3-6.8). Urine output was adequate but her weight gain was suboptimal. Wrist and knee x-rays, ultrasound kidneys and blood gas were all normal.

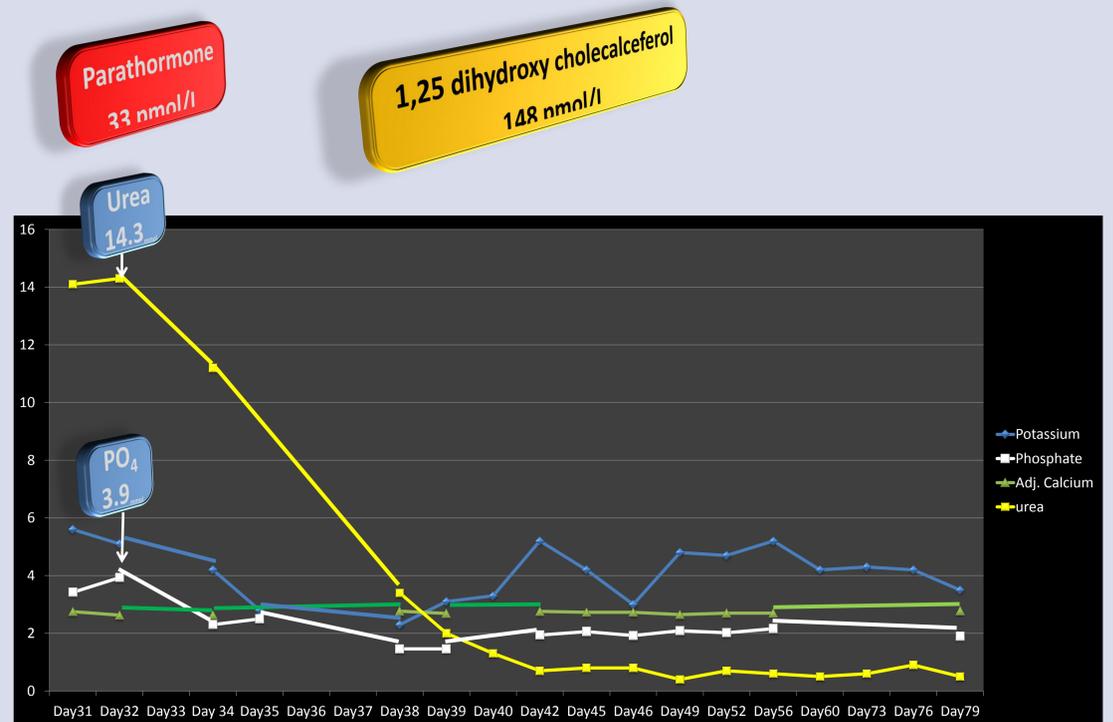
Furosemide was changed to Chlorothiazide. Breast milk fortifier was discontinued. Following advice, calcium supplement was started (despite normal calcium 2.53 mmol/L and adjusted calcium 2.63 mmol/L). The phosphate and parathormone levels returned to normal

Conclusion

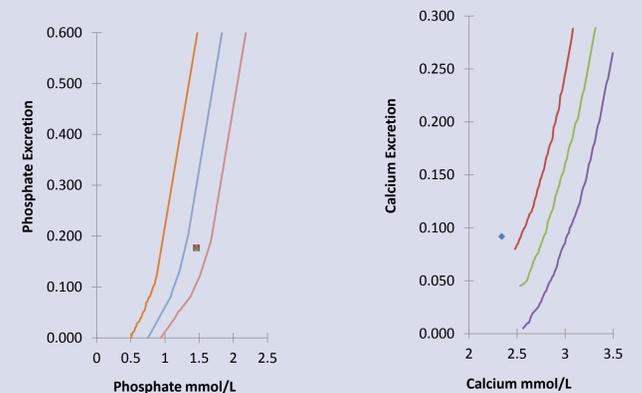
Despite thorough investigations, we were not able to identify a cause for this hyperphosphataemia. **Parathyroid hormone resistance** was considered, which may have been driven by relative hypocalcaemia even though the serum calcium levels were normal.

One possible explanation was the Furosemide causing a hypocalcaemia which in turn caused the hyperparathyroidism but resistance to the parathyroid hormone occurred to avoid calcium depleting the bones which explained the normal calcium.

The other explanation was **the fortification** with SMA BMF. A 2g sachet provides 23mg of phosphorus compared to 14mg in preterm and 15mg in mature breast milk. Commercial human milk fortifiers are predominantly a protein and mineral supplement. They also typically contain additional calories, electrolytes and vitamins.

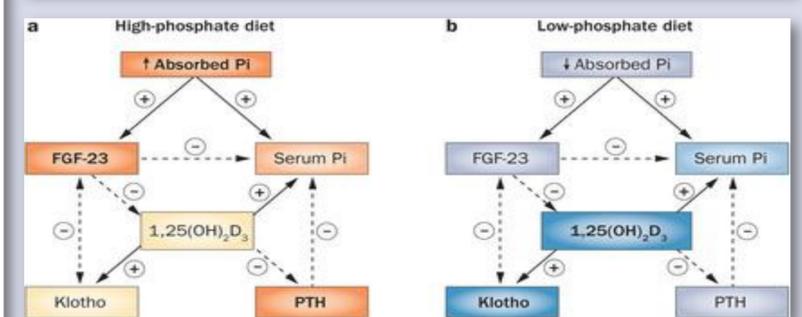
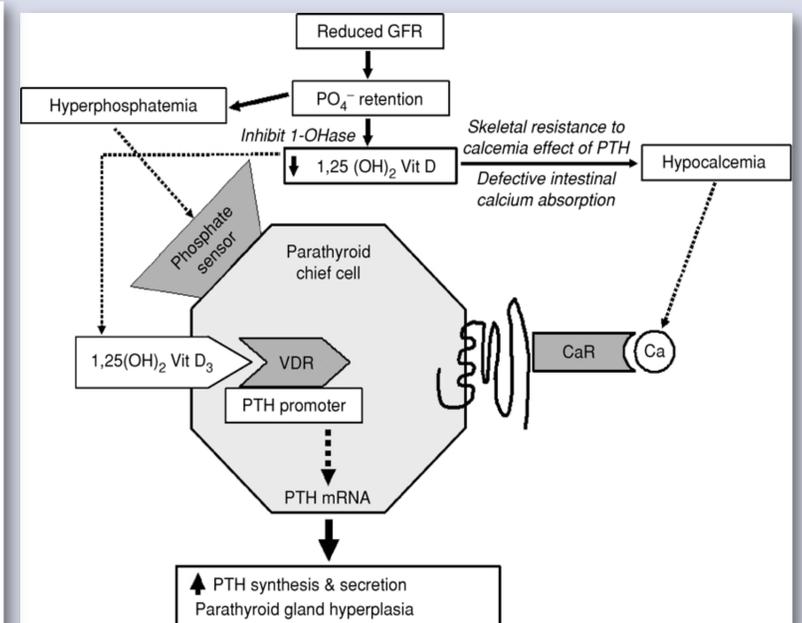


TMP/L GFR	1.364	mmol/L GFR	0.71-1.36
Phosphate Excretion	0.177	mmol/L GFR	0.05-0.22
TmCa/L GFR	N/A		
TmCa/L GFR (Corrected)	-		
Calcium Excretion	0.092	mmol/L GFR	
Calcium/Creatinine Ratio	2.700		0.30-2.00
Sodium Excretion	1.360	mmol/L GFR	1.0-1.5



Nutritional information for SMA Breast Milk Fortifier

		Preterm (per 100 ml)	Mature (per 100 ml)	SMA BMF (per 2g sachet)
Energy	kJ	293	289	31
	kcal	70	69	7.3
Protein	g	1.8	1.3	0.5
Carbohydrate	g	7	7.2	1.2
Fat	g	4	4.1	0.08
Fibre		ns	nil	nil
Sodium	g	0.03	0.015	0.009
Vitamins				
Vitamin A	μg	ns	58	135
Vitamin D	μg	ns	0.033 ¹	3.8
Vitamin E	mg	ns	0.34	1.5
Vitamin K	μg	ns	0.24 ³	5.5
Vitamin C	mg	ns	4.00	20
Thiamin	mg	0.01	0.02	0.11
Riboflavin	mg	0.03	0.03	0.13
Niacin	mg	0.21	0.2	1.8
Vitamin B ₆	mg	0.01	0.01	0.13
Folic Acid	μg	3.1	5.00	15
Vitamin B ₁₂	μg	0.02	0.05-0.1 ¹	0.15
Biotin	μg	1	0.7	0.75
Pantothenic Acid	mg	0.23	0.25	0.45
Minerals				
Potassium	mg	60	58	14
Chloride	mg	59	42	8.5
Calcium	mg	22	34	45
Phosphorus	mg	14	15	23
Magnesium	mg	2.5	3	1.5
Zinc	mg	0.4	0.3	0.13
Manganese	μg	ns	0.8	2.3
Others				
Osmolality	mOsm/kg H ₂ O	302 ¹	269 ¹	37 ¹
Potential Renal Solute Load	mOsm/L	68		



References

- <http://www.smahcp.co.uk/Portals/0/CONTENT/Images/Products/PretermRange/BreastMilk/Datacard/BMF.pdf>
- <http://www.nature.com/nrneph/journal/v10/n5/full/nrneph.2014.49.html>
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