Characterization of Postnatal Sodium Fluctuation in Very Preterm Neonates

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Background and Aims

Large variations of serum sodium (Na) are associated with increased morbidity and mortality in adults. However, evidence is low in pediatrics and even more so in preterm infants. We aimed to identify factors influencing Na-fluctuations during the first 28 days of life in preterm infants <32 weeks gestational age (GA).

Methods

This retrospective study included all preterm neonates born 2007-2014 with GA <32 weeks or birth weight <1500g at the University Children's Hospital Berne, Switzerland.

Seven parameters were analyzed concerning their influence on Na variations: GA, delivery mode (spontaneous vs. c-section), small for gestational age (<10th percentile), gender, antenatal steroids and birthweight.

Descriptive modelling included non-linear mixed modelling to fit data and to characterize covariate effects. Secondary parameters, such as predicted Na concentration, were accessed via simulations.

Description	Unit	Mean	SD	Median	IQR	Min, Max
Na at birth	mmol/L	133.2	2.0	133.3	[132.1, 134.5]	[124.4, 138.7]
Na peak	mmol/L	143.0	2.7	142.7	[141.1, 144.6]	[135.9, 154.1]
Na at end of observation	mmol/L	134.9	1.8	135.0	[133.8, 136.0]	[124.1, 142.0]
Time of Na increase	days	1.31	0.53	1.21	[1.00, 1.48]	[0.44, 7.08]
Time of Na peak	days	2.95	0.56	2.85	[2.60, 3.15]	[1.80, 8.65]

Results

A total of 901 preterm neonates with GA of 29.4 [interquartile range 27.4, 30.9] weeks and a total of 20714 Na measurements were eligible. Na at birth was 133.2 (±2.0) mmol/l and similar across patient groups. Na increase started at postnatal age (PNA) of 1.31 (±0.53) days and a Na peak of 143 (±2.7) mmol/l was observed at 2.95 (±0.56) days.

Neonates with a GA below 25 weeks had an Na peak concentration of 146.0 (± 3.5) mmol/L whereas neonates with GA equal or above 31 weeks had a significantly (p < 0.0001) lower peak of 142.0 (± 2.1) mmol/L.

After vaginal delivery (n = 154) preterm infants experienced a significantly (p < 0.0001) higher Na peak concentration 144.1 (± 2.5) mmol/L than those delivered by c-section 142.7 (± 2.7) mmol/L (n = 689).

Preterm infants born SGA (n = 122) had a significantly (p < 0.0001) lower Na peak concentration of 141.9 (± 2.7) mmol/L compared to infants not being SGA 143.2 (± 2.7) mmol/L (n = 721).

After 10-15 days mean Na concentration was constant around 134 mmol/l. Antenatal steroids, gender and birthweight did not have an influence on sodium at baseline or peak sodium.

Interestingly, neither time of Na increase nor Na peak concentration were influenced by any of the assessed parameters.

Conclusion

Na fluctuations were increased in patients with decreasing GA, spontaneous delivery or decreased birthweight percentile, while gender, antenatal steroids and birthweight showed no significant effect. Modeling and simulation allowed to characterize individual serum sodium profiles and to identify risk factors in this very vulnerable population.