

Prevalence of critical electrolyte disturbances in children with complicated acute malnutrition: an observational study in Niger, Chad and Nigeria



R4NUT Conference
Nanterre, 21 November 2019



SOIGNER
INNOVER
ENSEMBLE

Antoine MAILLARD ALIMA



Context / problem

- Electrolyte disorders are frequent in severely malnourished children who require hospitalization.
- Hypokalaemia is particularly prevalent, and is associated with increased mortality (Talbert, 2012) : fatal cardiac arrhythmias and paralytic ileus (Daly, 2013)
- Therapeutic milks (F75 and F100) are formulated to address electrolyte disorders, with F75 used to stabilize children during the crucial first hospital days when critical hypokalemia ($K^+ < 2$ mM) is most likely.
- At a volume of 100 ml/kg/d, F75 provides 3.6 mmol/kg/d of potassium, which may not be sufficient to correct critical hypokalemia (Manary, 1997)

Purpose of the observational cohort

1. We aimed to document

- the prevalence of electrolyte disorders (K^+ and Na^+)
- the factors associated with critical hypokalemia at hospital admission

2. We aimed to describe

- the changes in serum K^+ over time in children presenting at hospital with an initial serum $K^+ < 3.0$ mmol/l
 - receiving standard nutrition therapy with F75 with or without rehydration,
 - receiving F75 and intravenous (IV) and/or oral K^+ correction.

Methodology

- Serum electrolytes were measured at admission to hospital
 - for severely malnourished children with vomiting or diarrhea
 - using a point-of-care laboratory device (iSTAT)
 - at 5 inpatient units in Niger, Chad and Nigeria
 - between July 2017 and July 2019.
- For most children with $[K^+] < 3.0$ at admission, electrolyte measurements were repeated every 24h until $K^+ > 3.0$.
 - All children received F75.
 - Those who were not dehydrated received IV KCl (1.0 mmol/kg over 3h) and / or oral KCl (3 mmol/kg over 24h) until serum $K^+ > 3.0$.

Results

Distribution of blood sodium and blood potassium levels reported (mmol/L) in 761 children

	Normal	Hypo				119-110		
		Mild	Moderate	Severe	Critical	119-110	Moderate	Severe
Na+ mmol/L	135-145	130-134	120-129	119-110	<110	119-110	150-159	> 160
K+ mmol/L	3.5-5.5	3.0-3.4	2.5-2.9	2.0-2.4	<2.0	119-110	6.0-6.4	>6.5
Na+, n (%)	244 (32.1)	229 (30.1)	211 (27.7)	56 (7.4)	NA	119-110	7 (0.9)	4 (0.5)
K+, n (%)	232 (30.5)	105 (13.8)	118 (15.5)	88 (11.6)	152 (20)	119-110	8 (1.1)	11* (1.4)

Results

Factors associated with critical hypokalemia at admission in ITFC

Variable	K+ t0 <2.0 (n=152) (20.0%)	K+ t0 >2.0 (n=609) (80%)	P-value
Mean age in months (SD)	16.5 (9.0)	14.6 (10.1)	<.0001
Mean MUAC at admission (SD)	110.9 (9.4)	110.5 (10.0)	0.71
Mean duration diarrhea at admis, days (SD)	7.2 (7.2)	5.4 (6.8)	<.0001
Deaths (%) (n=66)	17 (11.6)	49 (8.4)	0.3
Mean serum sodium t0 in mmol/L (SD)	127 (7)	133 (8)	< .0001
Severe hyponatremia at admis (%)	44 (28.9)	79 (13.0)	< .0001
Breastfeeding			<.05
Yes (n=362)	58 (16.0)	304 (84.0)	
No (n=252)	61 (24.2)	191 (75.8)	

Results

Serum potassium levels 24h after treatment (t1), following one of three interventions for children with critical hypokalemia at admission (t0)

Children with critical hypokalemia ($K^+ < 2$ mmol/L) at t0, n=118

	Standard (F75) including Resomal N=60		F75 + IV K^+ (1 mmol/kg/3 h) N=48		F75 + oral K^+ (3 mmol/kg/24 h) N = 10	
	n	%	n	%	n	%
Serum potassium at t1						
$K^+ < 2$	20	33.3	11	22.9	3	30.0
$K^+ [2-3]$	23	38.3	28	58.3	5	50.0
$K^+ > 3$	17	28.3	9	18.8	2	20.0

Conclusion and implications of the findings for operations and research

- Critical hypokalemia affected 20% of these children upon admission, and
 - one third failed to correct with F75/Resomal alone.
 - Oral potassium supplementation in addition to F75 is feasible, whereas IV supplementation is more complicated to manage (monitoring, equipment, nutritional oedemas). Oral correction even in children with critical hypokalemia, should be further investigated.
- Questions also raised re: other nutrients in addition to potassium, (i.e. vitamin B1) suggest the current F75 formulation merits re-consideration (Hiffler, 2017).
- Severe hyponatremia ($\text{Na}^+ < 120 \text{ mmol/L}$) is 14 times more prevalent than hypernatremia and is not accounted for in standard nutrition protocols.

QUESTIONS AND ANSWERS
AVAILABLE
ON THE R4NUT WEBSITE