COMPARISON OF ISOTONIC AND HYPOTONIC INTRAVENOUS FLUIDS IN TERM NEWBORNS: IS IT TIME TO QUIT HYPOTONIC FLUIDS

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BACKGROUND

- There is currently no clear consensus on the optimal composition of maintenance intravenous therapy for newborns.
- Conventionally, hypotonic fluids which contains lower sodium levels than blood, have been preferred for newborns.
- NICE guideline recommends the use of isotonic fluids as maintenance fluid therapy in term newborn infants (1)
- However, there is no clear evidence supporting this recommendation (2).

OBJECTIVE

- This study aims to compare isotonic (5% dextrose in 0.9%NaCl) and hypotonic (5% dextrose in 0.45%NaCl) parenteral fluid therapies in hospitalized term newborns with regard to changes in plasma Na and complications related with fluid therapy

METHOD

- Retrospective cohort study in Dokuz Eylul University Hospital NICU, January 2016 and April 2018
- Infants received either isotonic or moderately hypotonic fluids (according to consultant doctors' decision)

Inclusion criteria

- i. Term Newborns > 37 gw
- ii. Less than 28th postnatal days
- iii. IV fluid therapy after 48 postnatal hours,
- iv. Isonatremic or mildly dysnatremic (pNa 130 to 155 meq/ L)
- v. Receiving at least 50% of the total daily fluid volume parenterally.

Exclusion criteria

- i. Diagnoses requiring specific fluid tonicity and volumes (i.e. metabolic or endocrine disorders, congenital anomalies, asphyxia, sepsis and conditions that create abnormal loss of fluid)
- ii. Infants having missing data

Study groups

- Two groups were defined according to initial parenteral fluid therapy:
- i. Hypotonic fluid group (0.45% NaCl + 5% Dextrose, 77 meq / L NaCl) or
 - ii. Isotonic fluid group (0.9% NaCl + 5% dextrose, 154 meq / L NaCl)

RESULTS

- 108 patients were included , 51 received isotonic fluid and 57 received hypotonic fluid
- The most common presenting symptoms were:
- i. excessive weight loss over 10% (n=74, 68.5%)
 - ii. jaundice (35.5%) and
 - iii. fever (14%)

Table 1. Clinical characteristic of infants at the beginning of the IV fluid therapy.

	Isotonic n= 51	Hypotonic n= 57	P
Birth weight (grams)*	3327 ±351	3111±387	0.93
Gestational week*	38.6±1.1	38.3±1.1	0.142
Postnatal day of admission*	3.70±1.41	3.45±1.0	0.392
Gender (female %) **	22 (43.1)	27(47.4)	0.702
Type of delivery (C-section) **	36 (70.6)	38 (66.7)	0.684
Weight loss, birth weight % *	10.76 ±3.04	10.99±2.61	0.210
Weight loss > 10% **	37 (72.5)	36 (63.2)	0.312
Initial Na level*	149.19±3.88	151.33±2.84	0.003
Hypernatremic babies (baseline pNa > 150 meq/L) **	24 (47.1)	37 (64.9)	0.081
Initial BUN*	21.87± 10.96	20.23 ±13.98	0.654
Initial Creatinine*	0.76±0.19	0.82±0.23	0.278
Initial total fluid (cc/kg/day)*	132±28	130±22	0.997
Initial parenteral fluid (cc/kg/day) *	87±35	79 ±28	0.334
*Mean ± SD, Student t test ** Frequency (%), Pearson's chi-squared test			

Table 2. Selected outcomes of the infants

Outcomes	Isotonic n=51	Hypotonic n=57	P
ΔpNa (meq/kg/h) **	0.27±0.21	0.48±0.28	0.001
- ΔpNa in isonatremic sg	0.22±0.15	0.28±0.17	0.176
- ΔpNa in hypernatremic sg	0.32 ± 0.24	0.64±0.32	0.004
Critical ΔpNa (>0.5meq/h) n(%)	3 (6.0)	20 (35.1)	0.001
pNa at the end of IV fluid therapy **	143.83 ± 3.43	142.52 ± 2.61	0.759
Morbidity due to fluid therapy	-	-	-
Duration of IV fluid therapy *(hours)	18.31±6.43	17.02±6.56	0.341
*Odds Ratio and 95% Confidence intervals **Mean ± SD			

(To control the effect of initial pNa level as a confounding factor, a general linear model procedure was used. The corrected model combining the type of initial fluid therapy and initial pNa level was significant (f= 14.03, p<0.001 with CI 95%, observed power 99.9 %)

CONCLUSION

- ✓ Hypotonic fluid therapy, even 5% dextrose in 0.45%NaCl can lead to unsafe plasma Na decreases in term newborns.
- ✓ The effect of hypotonic fluids on plasma Na decline rate increased significantly as the initial plasma Na concentration increased.
- ✓ Isotonic 0.9% saline in 5% dextrose solution results in a safe sodium decline rate without causing hypernatremia or any other complication in term newborns.
- ✓ Isotonic fluid is a safe option in mild hypernatremic patients instead of hypotonic or moderately hypotonic fluids.
- ✓ If more hypotonic fluids were used or severe hypernatremic babies were included, mean pNa drops in hypotonic group could be more dramatic

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