Comparison of ultrarapid and rapid intravenous hydration in pediatric patients with dehydration

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報告：PGY賴紀妘
指導：楊毓錚醫師
990630

Objective

- To test ultrarapidly infused vs. rapidly infused intravenous(IV) hydration in pediatric patients with AGE (acute gastroenteritis) and moderate dehydration.

Methods

- Eligible criteria:
  - Patient age: 3-36 months
  - Vomiting and /or diarrhea and moderate dehydration.
- Groups— after failing an oral fluid challenge:
  - Ultra: 50ml/kg normal saline for 1 hour
  - Standard: 50ml/kg normal saline for 3 hours
- Recording:
  - Weight, serum electrolyte, urine before/after IV hydration.
  - Input/output, vital signs houtly during study.

Methods

- Discharged after fulfilling specified criteria
- Questionnaire 24 hour after discharge
- Comparison data:
  - Success and timing of rehydration,
  - number of returned and/or admitted,
  - output furing the rehydration period,
  - laboratory differences,
  - serious complications

Table 1 Determination of dehydration

Variable	Mild (3%-5%)	Moderate (6%-9%)	Severe (>10%)
Blood pressure	Normal	Normal	Normal to reduced
Quality of pulses	Normal	Normal or slightly decreased	Moderately decreased
Heart rate	Normal	Increased	Increased *
Skin turgor	Normal	Decreased	Decreased
Fontanel	Normal	Sunken	Sunken
Mucous membranes	Slightly dry	Dry	Dry
Eyes	Normal	Sunken orbits	Deeply sunken
Extremities	Normal capillary refill	Delayed capillary refill	Cool, mottled
Mental status	Normal	Normal to listless	Lethargic or comatose
Urine output	Slightly decreased	<1 mL/kg per hour	<1 mL/kg per hour
Thirst	Slightly increased	Moderately increased	Very thirsty

Adapted from Duggan et al. found in the American Academy of Pediatrics guideline [3].
* Bradycardia may appear in severe cases.

Result

- September 2003~April 2007
- 386 potential eligible dehydrated subjects → Enrolled 92 subjects that had AGE and moderate dehydration
- 88 of 92 subjects completed the study
  - 4 patient failed treatment (1ultra and 3 standard)→ hospitalized, excluded form the study
- 45 ultra(97.8%), 43 standard(93.5%)
- Groups were similar

Table 2 Baseline characteristics

Characteristic	Ultra, n = 45	Standard, n = 43	*P*
Sex	18 female (40%), 27 male (60%)	16 female (37%), 27 male (63%)	.788
Predominant ethnicity	40 Latino (89%)	41 Latino (95%)	.367
Days of symptoms (by history)			
1-2	25 (55%)	25 (58%)	.633
3-4	14 (31%)	15 (35%)	
5-6	3 (7%)	2 (5%)	
>7	3 (7%)	1 (2%)	
Occurrence of vomiting (by history)			
0	1 (2%)	1 (2%)	.367
1-4	3 (7%)	2 (5%)	
5-10	13 (29%)	17 (39%)	
11-15	12 (27%)	9 (21%)	
16-20	6 (13%)	11 (26%)	
>20	10 (22%)	3 (7%)	
Occurrence of diarrhea (by history)			
0	9 (20%)	5 (12%)	.789
1-4	6 (13%)	7 (16%)	
5-10	10 (22%)	10 (23%)	
11-15	4 (9%)	7 (16%)	
16-20	5 (11%)	3 (7%)	
>20	11 (25%)	11 (26%)	
Cap refill time (s)	13 (30%) >2, 31 (70%) <2	11 (26%) >2, 32 (74%) <2	.679
Tears (none)	36 (80%)	34 (79%)	.914
Heart rate (mean)	147 (SD, 25.9)	154 (SD, 21.3)	.163
Age (mo)	18.7 (SD, 9.7)	16.7 (SD, 7.5)	.288

Result – I/O

	ultra	standard
Emesis	69 ml/h	63 ml/3h→ 21 ml/h
Urine	93 ml/h	71 ml/3h → 24 ml/h
stool	45 ml/h	75 ml/3h → 25 ml/h P=0.042

Result – weight gain, heart rate

	ultra	standard	
Weight	11.3kg	10.8kg	
Weight gain	474g(4.2%)	408g(3.8%)	P=0.343
Heart rate	147	154	
Heart rate after hydration	122	123	HR decrease P=0.163

Result – serum and urine biochemistry

Table 3 Mean laboratory values

Test		Ultra	Standard	*P*
Na (mmol/L)	Initials	140 ± 4.4	141 ± 4.1	.044
	Final	141 ± 3.7	142 ± 3.9	NS
K (mmol/L)	Initial	4.3 ± 0.53	4.4 ± 0.64	NS
	Final	4.0 ± 0.56	4.1 ± 0.57	NS
CO_2 (mmol/L)	Initial	16.8 ± 3.5	16.5 ± 2.6	NS
	Final	15.1 ± 2.7	16.0 ± 3.1	NS
Blood urea nitrogen	Initial	13.2 ±5.8	15.0 ± 7.4	NS
(mmol/L)	Final	10.9 ± 4.8	11.7 ± 6.2	NS
Cr (mg/dL)	Initial	0.4 ± 0.11	0.4 ± 0.11	NS
	Final	0.3 ± 0.08	0.3 ± 0.10	NS
Glucose (g %)	Initial	96 ± 22.9	97 ± 19.6	NS
	Final	79 ± 18.1	79 ± 12.6	NS
Urine specific gravity	Initial	1025 ± 6.7	1025 ± 7.7	NS
	Final	1016 ± 7.5	1020 ± 8.3	.028

NS indicates not significant.

Results

- No subject had evidence of serious complications
- 91% of subjects completed the follow-up questionnaire→ no differences
- 13 (14.8%) of 88 patient returned:
  - 7 ultra (15.6%) and 6 standard (14.0%) (P=0.999)
    - 6 ultra received oral fluid, 1 received IV fluid
    - 5 ultra standard received oral fluid, 1 received IV fluid
  - all were discharged

Discussion

- In the pilot study, they showed that ultrarapid IV hydration for 1 hour is comparable with standard hydration for 3 hours.

Discussion

- IV hydration studies have shown that IV fluid therapy is effective, changes clinical outcome, and/or prevents hospitalization
- Pediatric nephrologists: Most believed that prolonged deficit therapy is outdated and that high-volume fluid resuscitation, 20 to 40 mL/kg, should be implemented
- Despite multiple studies showing the use and effectiveness of IV hydration, amounts and rates of fluid administration differ, and therefore, the optimal administration rate for IV hydration has not been defined.

Conclusion

- Based on this pilot study, **ultrarapid hydration for 1 hour** preliminarily appears to be an efficacious alternative to standard rapid hydration for 3 hours and **improves emergency department throughput time**

Urinalysis is not reliable to detect a urinary tract infection in febrile infants presenting to the ED

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指導：楊毓錚醫師

Introduction

- Urinary tract infection—a common source of serious bacterial infection in febrile infants < 2 years old.
- Urinalysis(UA) vs. urine culture(UCx)

Method

- December 2002~December 2003
- Febrile infant: 55000 patient annually(27% children) in a tertiary care hospital
  - <3 month, temperature ≧38˚C
  - 3~24 month, temperature ≧39˚C
- Age, sex, temperature, urinalysis, urine culture result form electronic hospital archives

Result

985 febrile infant male 55% mean age 12.6 month median age 12 month	
495 UA	449 UCx
435 (78% eligible patient) both UA and UCx from the same specimen	
60 UA only (6 positive reuslt)	14 UCx only (0 positive result)

Result

- 45 positive results in UCx (10.3%).
  - Escherichiacoli (33), Enterococcus (5), Klebsiella (3), Proteus (3), and Enterobacter (1)
  - Females accounted for 33 (73%)

	UCx +	UCx -
UA +	29	34
UA -	16	357

Result

- UA for predicting a positive UCx result
  - Sensitivity: **64%**
    (95% confidence interval [CI], 49%-78%)
  - Specificity: **91%**
    (95% confidence interval [CI], 93%-97%)
  - Positive predictive value: **46%**
    (95% CI, 31%-53%)
  - Negative predictive value: **96%**
    (95% CI, 93%-97%)

Conclusion

- Urinalysis is **not** reliable for the detection of urinary tract infection in febrile infants when compared with urine cultures.