



Deficit Therapy

Chapter 53 Nelson 2011

Fluid Therapy Workshop

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Table 54-1 CLINICAL EVALUATION OF DEHYDRATION

Mild dehydration (<5% in an infant; <3% in an older child or adult): Normal or increased pulse; decreased urine output; thirsty; **normal physical findings**

Moderate dehydration (5-10% in an infant; 3-6% in an older child or adult): Tachycardia; little or no urine output; irritable/lethargic; sunken eyes and fontanel; decreased tears; dry mucous membranes; mild delay in elasticity (skin turgor); **delayed capillary refill (>1.5 sec);** cool and pale

Severe dehydration (>10% in an infant; >6% in an older child or adult): Peripheral pulses either rapid and weak or absent; decreased blood pressure; no urine output; very sunken eyes and fontanel; no tears; parched mucous membranes; delayed elasticity (poor skin turgor); **very delayed capillary refill (>3 sec);** cold and mottled; limp, depressed consciousness

Dehydration

- **Most cases can be managed with oral rehydration**
- **Mild to mod. hyponatremic or hypernatremic dehydration can be managed with**

Oral rehydration

M + D + Ongoing loss

- **Maintenance fluids**
- **Deficit replacement**
- **Replacement fluids (if they have continued excessive losses)**

**Acute correction of
intravascular volume
depletion**

- **NS / RL**

**Maintenance fluid
therapy**

- **$\frac{1}{2}$ NS / 0.2 NS**

Ongoing Loss

- **Based on Table**

Fluid Osmolality

- Normal plasma osmolality is 285-295 mOsm/kg
- Infusing an intravenous solution peripherally with a **much lower osmolality** can cause water to move into red blood cells, leading to **hemolysis**.
- Thus, intravenous fluids are generally designed to have an osmolality that is either close to 285 or greater

- 0.2NS **should not** be administered peripherally
- But D5 0.2NS or D5 1/2NS + 20 mEq/L KCl can be administered.

- **BW < 10 Kg 0.2 NS**
- **Larger children and adults1/2NS**

Table 53-4 COMPOSITION OF INTRAVENOUS SOLUTIONS

FLUID	[Na]	[Cl ⁻]	[K ⁺]	[Ca ²⁺]	[LACTATE ⁻]
Normal saline (0.9% NaCl)	154	154	—	—	—
Half-normal saline (0.45% NaCl)	77	77	—	—	—
0.2 normal saline (0.2% NaCl)	34	34	—	—	—
Ringer lactate	130	109	4	3	28

Table 54-2 FLUID MANAGEMENT OF DEHYDRATION

1 Restore intravascular volume:

Normal saline: 20 mL/kg over 20 min

Repeat as needed

2 Rapid volume repletion: 20 mL/kg normal saline or Ringer lactate (maximum = 1 L) over 2 hr

3 Calculate 24-hr fluid needs: maintenance + deficit volume

Subtract isotonic fluid already administered from 24-hr fluid needs

Administer remaining volume over 24 hr using D5 half-normal saline + 20 mEq/L KCl

4 Replace ongoing losses as they occur

Shock

A fluid bolus, usually 20 mL/kg of the isotonic fluid, over approximately 20 min.

- The child with severe dehydration may require multiple fluid boluses.
- In a child with a known or probable metabolic alkalosis (the child with isolated vomiting), LR should not be used because the lactate would worsen the alkalosis.

Subtle volume depletion

Subtle volume depletion should receive:

20 mL/kg (maximum of 1 L) of isotonic fluid (NS, LR) over 1-2 hr

Then be switched to D5 1/2NS + 20 mEq/L KCl at a standard maintenance rate

Deficit Volume

Isotonic Fluid + 20 mEq/L KCl

- In isonatremic or hypoNa dehydration, the entire fluid deficit is corrected **over 24 hr**
- A slower approach is used for hyperNa dehydration
- To assure that the intravascular volume is restored, the patient receives an additional 20-mL/kg bolus of an isotonic fluid over 2 hr.
- The child's total fluid needs are added together

1. 20 ml/kg NS/ 20 min



2. 20 ml/kg NS/ 2 hr



3. Deficit + M – received Fluid / 24 hr

D: (100 ml/Kg NS for 10% Def.)

M :½ NS



4. Ongoing Loss



5. Potassium 20 mEq/L

after urination

Clinical improvement

PR: Lower heart rate

BP: Normalization of blood pressure

CF: Improved perfusion (normal CF)

UOP: Better urine output

General Appearance: Alert affect

Ongoing Loss (Diarrhea)

Table 53-7 REPLACEMENT FLUID FOR DIARRHEA

AVERAGE COMPOSITION OF DIARRHEA

Sodium: 55 mEq/L

Potassium: 25 mEq/L

Bicarbonate: 15 mEq/L

APPROACH TO REPLACEMENT OF ONGOING LOSSES

Solution: D5 0.2 normal saline + 20 mEq/L sodium bicarbonate + 20 mEq/L KCl

Replace stool mL/mL every 1-6 hr

Ongoing Loss (Emesis)

Table 53-8 REPLACEMENT FLUID FOR EMESIS OR NASOGASTRIC LOSSES

AVERAGE COMPOSITION OF **GASTRIC FLUID**

Sodium: 60 mEq/L
Potassium: 10 mEq/L
Chloride: 90 mEq/L

APPROACH TO REPLACEMENT OF ONGOING LOSSES

Solution **normal saline + 10 mEq/L KCl**
Replace output mL/mL every 1-6 hr

Oliguria / Polyuria

Table 53-9 ADJUSTING FLUID THERAPY FOR ALTERED RENAL OUTPUT

OLIGURIA/ANURIA

Start patient on replacement of insensible fluid losses (25-40% of maintenance)
Replace urine output mL/mL with half-normal saline

POLYURIA

Start patient on replacement of insensible fluid losses (25-40% of maintenance)
Measure urine electrolytes
Replace urine output mL/mL with solution based on measured urine electrolytes

Surgery

During surgery and in the recovery room for 6-8 hr postoperatively: Isotonic fluids (**NS, LR**)

The rate **2/3** of the calculated maintenance rate

Post up: **½ NS**

[Unless there is a specific indication to use maintenance sodium (30 mEq/L NaCl)]

Electrolytes should be measured at least daily

Third space fluid

- **Burn, Abdominal Surgery**
- **Replacement with an isotonic fluid ml/ml**
NS/ RL

Chest tube

- Replacement with an isotonic fluid ml/ml

NS / RL / Albumin 5%

Condition	Fluid Rate	Solution
Maintenance Fluid	0-10 kg: 100 ml/kg/day 11-20 kg: 1000 ml + 50 ml/kg for each kg > 10 kg >20 kg: 1500 ml + 20 ml/Kg for each kg > 20 kg (max. 2400 ml)	D5 + 30 mEq/L NaCl + 20 mEq/L KCl
Shock	20 mL/kg of the isotonic fluid, over 20 min (may require multiple fluid boluses)	NS or RL
Isonatremic Dehydration	Rapid Volume repletion: 20 ml/kg (max. 1 lit) over 2 hr Maintenance + Defecit Volume + Ongoing Loss	Deficit Volume : Isotonic Fluid + 20 mEq/L KCl
Subtle volume depletion	20 mL/kg (max. of 1 L) of isotonic fluid over 1-2 hr then be switched to maintenance	NS or LR D5 ½ NS + 20 mEq/L KCl
Hypernatremic Dehydration	20–30% greater than maintenance	½ NS + 20 mEq/L KCl
Hypernatremia with Sodium overload	Maintenance + Ongoing Loss ± Loop Diuretics	Sodium free intravenous fluid D5 + 20 mEq/L KCl
Pure Water loss (Diabetes Insipidus)	Maintenance + Deficit + Ongoing Loss	D5 + 30 mEq/L NaCl (more hypotonic fluid) + 20 mEq/L KCl
Hyponatremic Dehydration	Maintenance + Deficit + Ongoing Loss	Isotonic saline + 20 mEq/L KCl
Hypervolemic hyponatremia	Water and sodium restriction + Diuretics 2/3– 3/4 Maintenance Fluid Renal Failure:Dialysis Nephrotic Syndrome: Albumin Heart Failure: improvement in cardiac output	D5 + 30 mEq/L NaCl + 20 mEq/L KCl
Ongoing Loss	Diarrehea (Replace stool ml/ml Q 1-6 hr)	D5 +30 mEq/L NaCl + 20 mEq/L Sodium bicarbonate + 20 mEq/L KCl
	Gastric Fluid (NG tube Loss) Replace out put ml/ml Q 1-6 hr	NS + 10 mEq/L KCl
Surgery	During surgery and for 6-8 hr postoperation (the rate is 2/3 of the calculated maintenance rate)	NS/ RL
	After surgery Electrolytes should be measured at least daily	½ NS
Third space fluid (burns or abdominal surgery)	Replacement with an isotonic fluid ml/ml	NS or RL
Chest tube	Replacement with an isotonic fluid ml/ml	NS or RL or Albumin 5%
Oliguria / Anuria	Insensible fluid loss (25-40% of Maintenance) + Urine out put	Insensible fluid loss = D5 Urine out put =1/2 NS