

# Fluid Therapy In Pediatrics

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# FLUID THERAPY

- Fluid therapy is used to correct body water and electrolytes disturbance, to restore and maintain blood volume, osmolality, pH and electrolyte composition and to restore normal physiological function.

Infant < 30 wks.	Other causes
Infant <1250 gm.	✓ Gastroenteritis (dehydration)
Sick Term Newborns	✓ Fever
✓ Severe birth asphyxia	✓ Deprivation
✓ Apnea	✓ Diabetes (Insipidus, mellitus - DKA)
✓ RDS	✓ Burns
✓ Sepsis	✓ Coma
✓ Seizure	✓ Diuretics
✓ Cystic fibrosis	✓ Intestinal Drainage

# MAINTENANCE FLUID

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*Maintenance fluid volume is calculated according to body weight:*

Body Weight	Fluid per Day
0-10 kg	100 mL/kg
11-20 kg	1,000 mL + 50 mL/kg for each kg > 10 kg
> 20 kg	1,500 mL + 20 mL/kg for each kg > 10 kg

- The **maximum** total fluid per day is normally 2,400 mL.
- Fluid of choice either :
- D5 ¼ NS + 20 mEq/L Kcl or D5 ½ NS + 20 mEq/L Kcl
- *The **maximum fluid rate** is normally 100 mL/hr.*
- 0-10 kg: 4 mL/kg/hr
- 10-20 kg: 40 mL/hr + 2 mL/kg/hr
- >20 kg: 60 mL/hr + 1 mL/kg/hr

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# TYPES OF CRYSTALLOIDS

## Ready Mixed Solutions (Electrolyte Content is meq per Liter)

	<u>Na<sup>+</sup></u>	<u>K<sup>+</sup></u>	<u>Cl<sup>-</sup></u>	<u>Bicarb<sup>++</sup></u>	<u>Ca<sup>++</sup></u>	<u>G/100 ml</u>	<u>mOsm/L</u>
D5-W						5	252
D10-W						10	506
Normal Saline (0.9%)	154		154				308
0.45% Na Chloride	77		77				154
0.45% Na Cl + 5% Dex	77		77			5	400
0.33% Na Cl + 5% Dex	56		56			5	350
D5-Normal Saline	154		154				560
D5-0.45% Na Chloride	77		77				406
D5-0.2% Na Chloride	34		34				321
D5-Ringer's Lactate	130	4	109	28	2.7		525
Ringer's Lactate	130	4	109	28	2.7		273
3% Na Chloride	513		513				1027

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# PEDIATRIC DRUG DOSAGE



- *Dose calculation on the basis of age, surface area and weight*

*Based on age (young's rule)*

- *Dose = Adult dose x  $\frac{\text{Age ( years)}}{\text{Age} + 12}$*

*Based on weight*

- *Dose = Adult dose x  $\frac{\text{weight(kg)}}{150}$*

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## FLUID COMPARTMENTS

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- TBW is divided between two main compartments: intracellular fluid (ICF) and extracellular fluid (ECF).
- In the fetus and newborn, the ECF volume is larger than the ICF volume.
- By 1 year of age the ratio of the ICF volume to the ECF volume approaches adult levels.
- The ECF volume is about 20-25% of body weight and the ICF volume is about 30-40% of body weight, close to twice the ECF volume.
- The ECF is further divided into the plasma water and the interstitial fluid.
- The volume of plasma water can be altered by a variety of pathologic conditions, including dehydration, anemia, polycythemia, heart failure, abnormal plasma osmolality, and hypoalbuminemia.
- The interstitial fluid, normally about 15% of body weight, can increase dramatically in diseases associated with edema such as heart failure, liver failure, nephrotic syndrome, and other causes of hypoalbuminemia.

# INTRAVENOUS FLUID THERAPY

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## Indications:

### *A. Diarrhea*

1. Severe dehydration ( $> 10\%$  of BW loss in infants)
2. Diarrhea is accompanied by severe uncontrolled vomiting
3. Inability to comply with oral fluids

### *B. Other indications:*

1. Hemorrhage
2. Shock
3. Electrolyte disturbances
4. Supplying fluids and food for patients who are unable to maintain oral intake.
  - In a collapsed patient IV fluids are given initially rapidly at a rate of 100 ml/min to avoid hypovolemia and irreversible shock.
  - Later on the fluid therapy is adjusted according loss in stools and sweat. Clinically by noting the neck veins & urine output.

# CRYSTALLOIDS

- They are aqueous solutions containing electrolytes.. Isotonic solutions are the most commonly used. These solutions contain sodium as the major osmotically active particle which contain either normal saline (0.9% Na Cl) or saline equivalent (lactated Ringer's solution).
- Advantages:
  1. Readily available
  2. Inexpensive
  3. Easily stored
  4. Reaction free.
  5. Quickly Correct the extracellular electrolyte and fluid deficit.
  6. Reduce blood viscosity
  7. Recently recommended for initial resuscitation of all forms of hypo-volemic shocks.
- Disadvantages:
  1. Large volumes are required to increase extravascular volume (edema)
  2. Excess or too rapid infusion can cause peripheral and pulmonary edema.
  3. If not proper Dose & Type, it will cause Electrolyte disturbances

# TYPES OF CRYSTALLOIDS

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## *1- Normal saline (NaCl 0.9%):*

- Is the most commonly used, osmolality is 308 M osm/kg.
- Other forms of saline are (0.45% NaCl, .45% NaCl + Glucose 5%)
- Distribution: Stays almost entirely in the Extracellular space
- 1 liter of normal saline gives increase in the blood volume of 300 ml.
- Indications that circulation is improving include normalization of BP, pulse pressure, heart rate, improvement in the mental status, warmth and color of the skin, improved acid-base balance, and increased urine output.
- Replaces Na, cl, water
- Leaves the blood rapidly → short duration.

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# ***MAINTENANCE AND REPLACEMENT THERAPY***

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## **Goals of maintenance fluids:**

1. Prevent dehydration
2. Prevent electrolyte disorders
3. Prevent ketoacidosis
4. Prevent protein degradation

## **Infants are more susceptible for water loss due to:**

1. Physiological inability of their renal tubules to concentrate
2. Higher metabolic rate
3. Larger body surface area
4. Poorly developed thirst mechanism
5. Larger turnover water exchange

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