

Maintenance fluids in critically ill children

Goal of maintenance fluids:

Preserve the extracellular volume while maintaining a normal electrolyte balance

Changes in last decade: Hyponatremia a new worry

- 1.** Hospital acquired hyponatremia and hyponatremic encephalopathy can cause demise of patients in first 24-48 hours of fluid therapy
2. Fluid overload (10%) has been associated with poor outcome in critically ill children
3. Multiple disease states, physiological triggers and drugs which can cause arginine vasopressin excess (non- osmotic state) increasing the risk of hyponatremia
4. Hypotonic fluids have been found to add fuel to fire by increasing risk of hyponatremia.

Hyponatremia encephalopathy: a worry in children?

Children have increased ratio of brain to intracranial volume with other common risk factors like brain injury, hypoxemia making them high risk of hyponatremic encephalopathy.

Type of fluids:

Isotonic fluids have been looked as alternative and most of the guidelines prefer to use them as maintenance fluids.

Normal saline, Ringer lactate and balanced salt solution (Plasmalyte) have been used.

Many of the studies suggested that restricting hypotonic fluid in critically ill state will prevent hyponatremia, however they failed to justify in research and clinical practice.

Using isotonic fluids definitely reduced the risk of hyponatremia in hospital. However most of the current studies have removed patients of heart failure, kidney injury, cirrhosis and nephrotic syndrome.

Complications of isotonic fluid:

Hyperchloremic metabolic acidosis has been a complication associated with normal saline. Hyponatremia once thought to be associated with normal saline has now been refuted. Fluid overload can happen with any type of fluid used.

Rate & amount of fluid administration:

This discussion is done after the child has been stabilized. Decision to administer maintenance fluids to a sick child is an ongoing process. Fluid rate has to be modified depending upon the hemodynamic status, primary illness, day of illness, fluid balance and electrolyte status. Though Holliday Segar overcalculates the amount of fluid, it remains the most commonly used formula to start amount of fluid. Below is a rough guideline for managing specific situations.

1. **CNS illness:** Start with 100 percent fluids, titrate according to your input output and sodium status. We may start with fluid restriction if clear cut evidence of SIADH is there at admission (patients shifted from one hospital to other)
2. **Respiratory illness:** start with 80 percent of maintenance fluids in pneumonia, asthma and bronchiolitis.
3. **Congestive heart failure & myocarditis:** 50 -60 percent of maintenance fluids is to begin with in pure CHF, may require more fluids in associated sepsis and diarrheal illness.
4. **Anuric kidney injury:** 30 to 40 % of the maintenance fluids which is electrolyte free.
5. **Nephrotic syndrome:** depends on case to case basis, may start with 80 percent of maintenance fluids.
6. **Diarrhea illness:** start with 100 percent maintenance, may require more in hyponatremia.
7. **Kidney tubular concentrating defects:** start with 1.2 times the maintenance fluids.

Balanced salt solution has been looked as an alternative to normal saline. With research currently under way for disease specific states and use of Plasmalyte, it may be more clear in future.

Current use is based on admission & 6 hour chloride , presence of AKI, nature od primary use.