Body Fluid Homeostasis:

*ADH and aldosterone regulate body water and sodium homeostasis in response to production of renin and angiotensin.
*Renin and angiotensin are released in response to fluid shifts detected by volume sensors located throughout the body
*Locations of the volume sensors are the left atrium, aortic arch and carotids.
*ADH may also be secreted in response to other triggers such as pain, stress, and vomiting- factors that are common in sick and hospitalized infants and children
*A low serum sodium does not reflect a total deficit of body sodium but rather an excess of total body water
*Potassium is the main intracellular cation and is conserved more effectively by the kidneys than sodium

IV Fluid Selection:

*Some IV fluids are designed to stay in the intravascular space to increase the intravascular volume- these are the isotonic fluids
*Other IV fluids are specifically designed so the fluid leaves the intravascular space and enters the interstitial and intracellular spaces.
*Isotonic crystalloids have a tonicity equal to the body plasma. When administered to a normally hydrated patient, isotonic crystalloids do not cause a significant shift of water between the blood vessels and the cells
*Hypertonic and Hypotonic fluids should not be routinely used but may be needed in situations where there is an extremely low or high sodium level.
*Institutions vary, but delivery of hypo/hypertonic fluids should be done with close medical observation such as in the intensive care setting
*When instituting IV fluids, it is generally a good idea to not include potassium supplementation until the patient has had good urine output

Calculating Fluid Needs in Pediatric Patients:

*Maintenance fluids are based on daily body water needs and are to replace daily losses that include urine (60%), stool(5%) and insensible losses from the lungs and skin(35%)-Insensible losses are increased in states of fever and pulmonary disease
*Maintenance fluid replacement presumes that there are no other ongoing fluid losses. In addition to the Holliday Seger Method of calculating maintenance fluid needs (4:2:1) there are occasions that the use of body surface area is needed to calculate maintenance fluid rates
*The calculation of body surface area is in meters squared- agents such as chemotherapy use this method of fluid calculation.
The **Holliday Seger Method** is the most common calculation of maintenance fluids rates
- Uses numbers for the average patient’s caloric expenditure
- Numbers are calculated from the insensible losses minus the net gain from water oxidation
- One cc of water is needed for each kilocalorie of energy expended
- Infants and children have higher metabolic rates and thusly require more fluid per kilogram of body weight

**Dehydration: Assessment and Management**
* **Acute weight loss** is the best indicator for the degree of dehydration
* The majority of patients with uncomplicated dehydration can be managed **without need for laboratory testing** and patients with significant underlying co-morbidities may benefit from basic metabolic testing- the bicarbonate is a useful indicator but is non-specific as to reason for dehydration- the presence of acidosis denotes moderate to severe dehydration
* Hypoglycemia is a common finding in moderate to severe dehydration and bedside blood sugar testing should be done routinely when administering fluid resuscitation
* Dehydration is not a **diagnosis**, but rather a symptom, of another underlying problem.
* The causes of dehydration are many and it is much more common in infancy and childhood and **not all dehydrated children require hospital admission**
* Fluid loss is easily recognized when the losses are external and more difficult if the losses are **internal from third spacing**
* Oral rehydration should be the **method of choice** for rehydration- when this is not possible or is incomplete then IV fluid rehydration should be instituted
* The use of anti-emetics in children, as well as administration in anti-diarrheal agents, should be limited, if not discouraged
* In children, it is recommended to start with **20cc/kg fluid boluses** unless there is a known history of congenital heart disease. Even in children with cardiac defects, severe dehydration must be addressed with fluid boluses and it is better to give fluid as a full bolus initially
* After each fluid bolus, a **repeat physical exam should be done** to rate the degree of dehydration and when there is resolution of dehydration, fluids containing glucose should be instituted

**Fluid Management: Special Circumstances**
* Diarrheal diseases are the **most common cause** of dehydration in children world wide
* Losses of gastric fluid is most commonly due to **vomiting** and Nasogastric tube suctioning
* Lactate-containing solutions should be used for diarrheal losses and not for losses of purely gastric components that lead to hypochloremic metabolic alkalosis- this is because the lactate will be converted to bicarbonate in-vivo
* Pyloric stenosis patients are an example of children with **hypochloremia and metabolic alkalosis**, as are dehydrated children with Cystic Fibrosis