National Pediatric Nighttime Curriculum
Summary of "Fluid Management and Dehydration"

Body Fluid Homeostatis:

*__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
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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 mush 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