ALTERATIONS IN FLUID, ELECTROLYTE AND ACID-BASE BALANCE

CHAPTER 18

LAURINE GAJKOWSKI, RN, ND, CPN

NURS 316

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OBJECTIVES

1. DESCRIBE NORMAL F/E STATUS FOR CHILDREN.
2. IDENTIFY THREATS TO F/E BALANCE IN CHILDREN.
3. DESCRIBE ACID-BASE BALANCE AND RECOGNIZE COMMON DISRUPTIONS.
4. PLAN NURSING CARE FOR CHILDREN EXPERIENCING F/E PROBLEMS AND ACID-BASE IMBALANCES.

1) YOUNG CHILDREN ARE AT RISK FOR F/E IMBALANCE DUE TO DIFFERENCES IN BODY FLUID COMPARTMENTS AND REGULATION SYSTEMS.
2) PEDIATRIC NURSES INSTITUTE MEASURES TO MAINTAIN NORMAL BODY FLUIDS IN WELL CHILDREN (SUCH AS EXERCISING IN HOT WEATHER) AND ILL CHILDREN (SUCH AS GASTROENTERITIS).
3) THE MOST COMMON ELECTROLYTE IMBALANCES INVOLVE SODIUM AND POTASSIUM.
4) NORMAL ACID-BASE BALANCE IS NECESSARY FOR PROPER CELL FUNCTION IN THE BODY.
5) ALKALOSIS OR ACIDOSIS HAVE EITHER A RESPIRATORY ORIGIN OR METABOLIC ORIGIN.

BODY FLUID

INTRACELLULAR FLUID (I C F)

- 2/3 OF BODY WATER
- MORE DIFFICULT TO DEHYDRATE
- CONTAINS LARGE AMOUNTS OF K^+

***EXTRACELLULAR FLUID (E C F)**

- 1/3 OF BODY WATER
- MORE EASILY LOST ⟹ DEHYDRATION
- CONTAINS MOSTLY Na^+, Cl^-, AND HCO_3^-
- LOCATION:
  - INTRAVASCULAR
  - INTERSTITIAL
  - LYMPH
  - TRANSCELLULAR

- BODY WATER PERCENTAGE FOR WEIGHT VARIES WITH AGE.
- NEWBORNS HAVE HIGHEST PERCENTAGE OF WATER.
- PERCENTAGE DECREASES WITH INCREASING AGE.

FLUID DIFFERENCES IN CHILDREN

Newborn

75% Total body water
- ECF 45%
- ICF 30%

Brain and skin occupy a greater proportion of body weight and are high in interstitial fluid

Infant

65% Total body water
- ECF 25%
- ICF 30–40%

High BSA promotes fluid loss

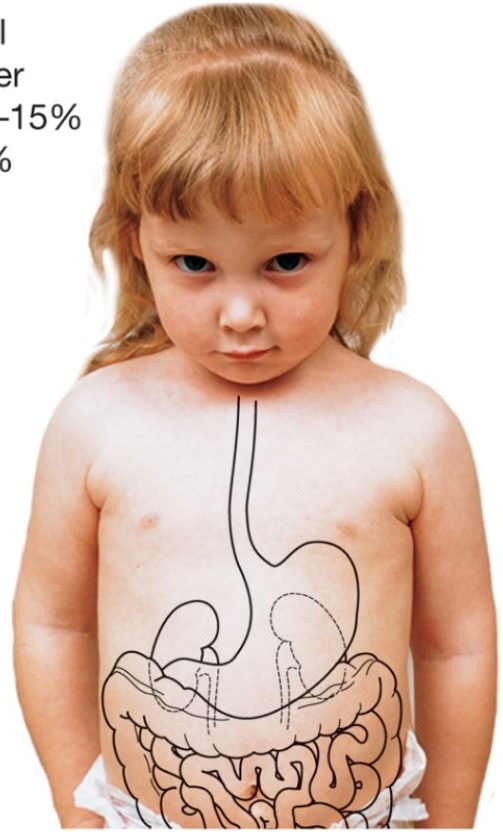
Little fluid reserve in intracellular fluid

5–6x greater fluid exchange daily

High metabolic rate requires generous fluid intake

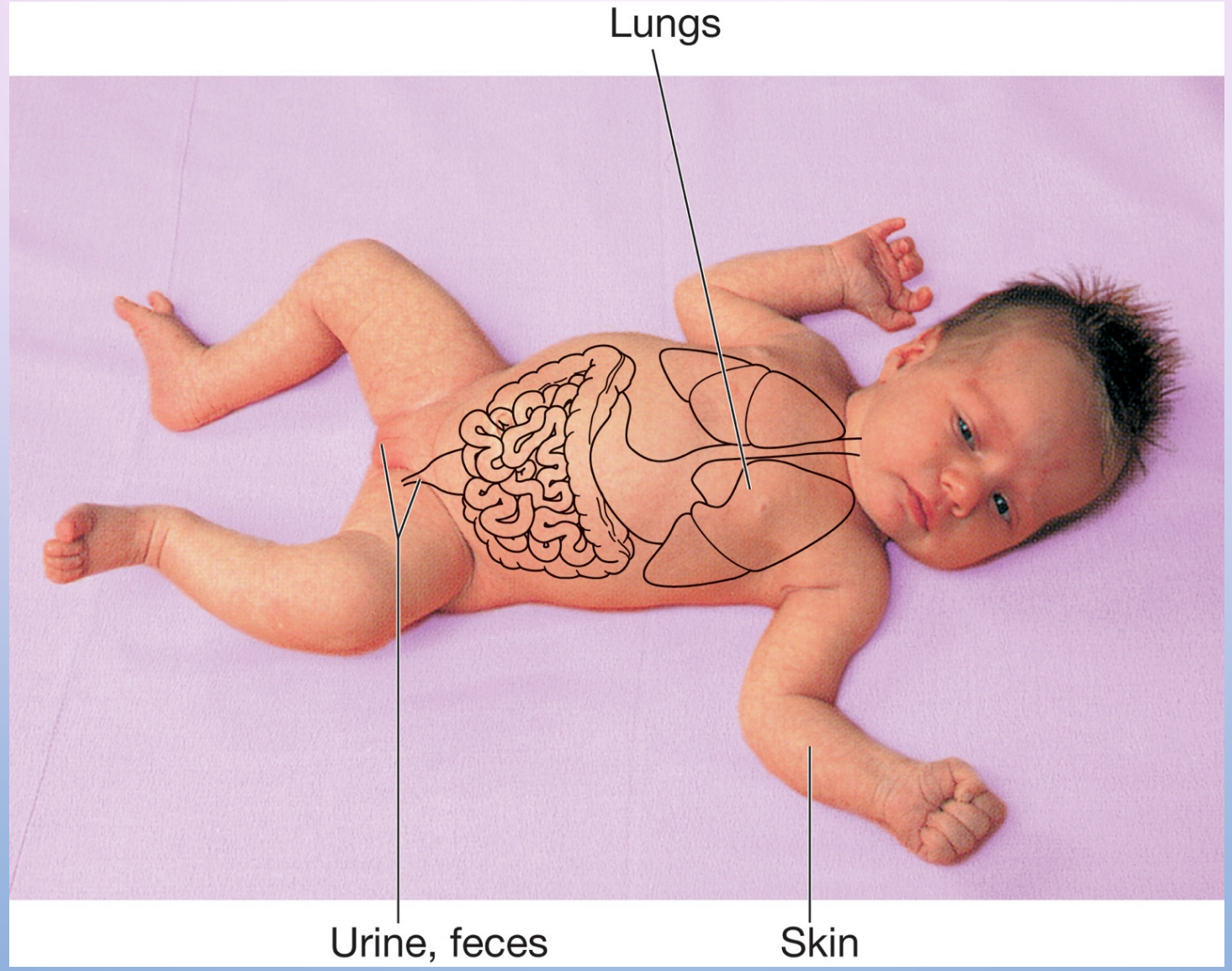
Child/Adolescent

50% Total body water
- ECF 10–15%
- ICF 40%



Kidneys are immature until 2 years and unable to conserve water and electrolytes or fully assist in acid–base balance

Figure 18-2 Normal Routes of Fluid Excretion from Infants and Children



F/E IMBALANCES

FLUID VOLUME DEFICIT

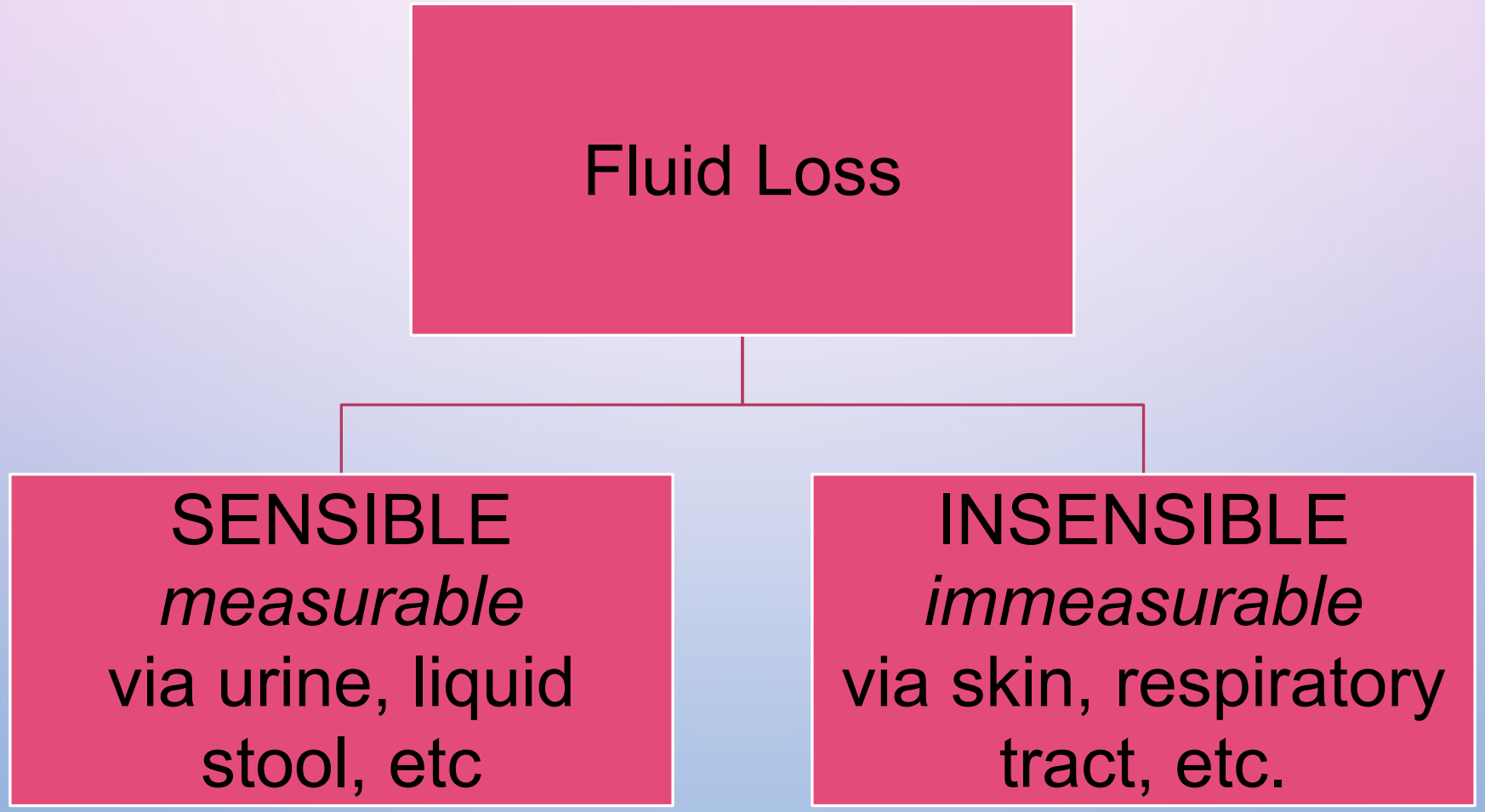
- DEHYDRATION
  - ISOTONIC (Na: 134-143 mEq/L)
  - HYPOTONIC
  - HYPERTONIC

  CHILDREN CAN HAVE SEVERE COMPLICATIONS FROM DEHYDRATION. DEATH CAN OCCUR.

FLUID VOLUME EXCESS

- INTERSTITIAL = EDEMA
- EXTRACELLULAR

UNDER NORMAL CONDITIONS, FLUID INGESTED SHOULD EQUAL FLUID LOST.



DEHYDRATION

- A CRITICAL CONDITION THAT RESULTS FROM AN EXTRACELLULAR FLUID LOSS (TOTAL OUTPUT > TOTAL INTAKE)
- POSSIBLE CAUSES
  - VOMITING
  - DIARRHEA
  - BURNS
  - HEMORRHAGE
  - NASOGASTRIC SUCTIONING AND DRAINAGE LOSS
  - NPO STATUS OR INADEQUATE FLUID/FOOD INTAKE DUE TO ILLNESS
  - OVERUSE OF DIURETICS OR ENEMAS
  - ADRENAL INSUFFICIENCY

Dehydration %	Mild 3-5%	Moderate 6-10%	Severe >10%
Mental status	normal	listless, irritable	lethargy, altered mental status
Heart rate	normal	increased	increased
Quality of pulses	normal	normal to decreased	decreased to thready
Capillary refill	normal	prolonged	prolonged
Blood pressure	normal	normal	normal to decreased
Respirations	normal	tachypnea	tachypnea, deep
Eyes	normal	slightly sunken, decreased tears	sunken, cries without tears
Fontanelle	normal	sunken	sunken
Urine output	normal to decreased	decreased	oliguric or anuric

NURSING CARE

1. PREVENT DEHYDRATION
2. PARENT EDUCATION FOR MILD OR MODERATE

   -PROVIDE ORAL REHYDRATION FLUIDS (1-3 TEASPOONS EVERY 10 MINUTES) OR 50/ML/KG IN 2-4 HOURS
3. ACUTE CARE FOR SEVERE

   -MONITOR WEIGHT, I&O, HR, BP, SKIN TURGOR, CAP REFILL, FONTANELLE (INFANT), URINE SPECIFIC GRAVITY

   -ADMINISTER IV FLUIDS

ECF EXCESS:
SALINE EXCESS OR VOLUME OVERLOAD

- EXCESSIVE ALDOSTERONE SECRETION
- CONGESTIVE HEART FAILURE
- LIVER CIRRHOSIS
- CHRONIC RENAL FAILURE
- GLUCOCORTICOID MEDICATIONS
- IMPROPER IV REGULATION BY NURSE

ECF (INTERSTITIAL) FLUID VOLUME EXCESS: EDEMA

- INCREASED BLOOD HYDROSTATIC PRESSURE
- DECREASED BLOOD OSMOTIC PRESSURE (LOW SERUM PROTEIN)
- INCREASED INTERSTITIAL FLUID OSMOTIC PRESSURE (HIGH CAPILLARY PERMEABILITY)
- BLOCKED LYMPH DRAINAGE

ELECTROLYTE IMBALANCES

SODIUM

POTASSIUM

HYPERNATREMIA

- INCREASED OSMOLALITY OF THE BLOOD
- SYMPTOMS ARE THIRST AND MENTAL CHANGES DUE TO SHRINKING OF BRAIN CELLS
- CAUSES ARE
    - A. LOSS OF MORE WATER THAN SODIUM (VOMITING AND DIARRHEA WITHOUT FLUID REPLACEMENT, INADEQUATE ORAL INTAKE, INCREASED ALDOSTERONE)

OR

    - B. GAIN OF MORE SODIUM THAN WATER (NO ACCESS TO WATER, TOO HIGHLY CONCENTRATED FORMULA, IV OR HYPERTONIC SALINE)

HYPONATREMIA

- DECREASED OSMOLALITY OF THE BLOOD, TOO DILUTE
- SYMPTOMS ARE MENTAL CHANGES DUE TO SWELLING OF BRAIN CELLS. IT IS A FREQUENT CAUSE OF SEIZURES IN INFANTS UNDER 6 MONTHS.
- CAUSES ARE
  - A. GAIN OF MORE WATER THAN SODIUM(TOO DILUTED INFANT FORMULA, TOO MUCH D_5W IV, TAP WATER ENEMAS)

  OR
  - B. LOSS OF MORE SODIUM THAN WATER (VOMITING AND DIARRHEA WITH TAP WATER REPLACEMENT NOT ORS, SWEATING, DIURETICS)
-

HYPERKALEMIA

- K^+ LEVEL ABOVE 5.5 mmol/L
- SYMPTOMS RELATE TO MUSCLE DYSFUNCTION: HEART, GI (CONSTIPATION), SKELETAL
- CAUSES: RENAL INSUFFICIENCY, TOO MUCH IV POTASSIUM INTAKE, SHIFT OF POTASSIUM OUT OF CELLS (ACIDOSIS)
- NURSING CARE: STOP IV POTASSIUM, EKG, SAFETY, RESTRICT HIGH POTASSIUM FOODS, ADMINISTER CLINICAL THERAPY TO LOWER K+ (DIALYSIS, KAYEXALATE, MEDS THAT DRIVE K+ INTO THE CELLS).

HYPOKALEMIA

- K^+ LEVEL BELOW 3.7 mmol/L
- SYMPTOMS RELATE TO MUSCLE DYSFUNCTION: HEART, GI, RESPIRATORY, SKELETAL
- CAUSES: EXCRETION OF K FROM GI TRACT (NG LOSSES, BULIMIA, MEDS)
- NURSING CARE: ARRHYTHMIAS, ASSESS FOR LEG WEAKNESS, TEACH ABOUT POTASSIUM RICH FOODS

ACID-BASE IMBALANCES

ACIDOSIS (TOO MUCH ACID)

ALKALOSIS (TOO LITTLE ACID)

RESPIRATORY ACIDOSIS

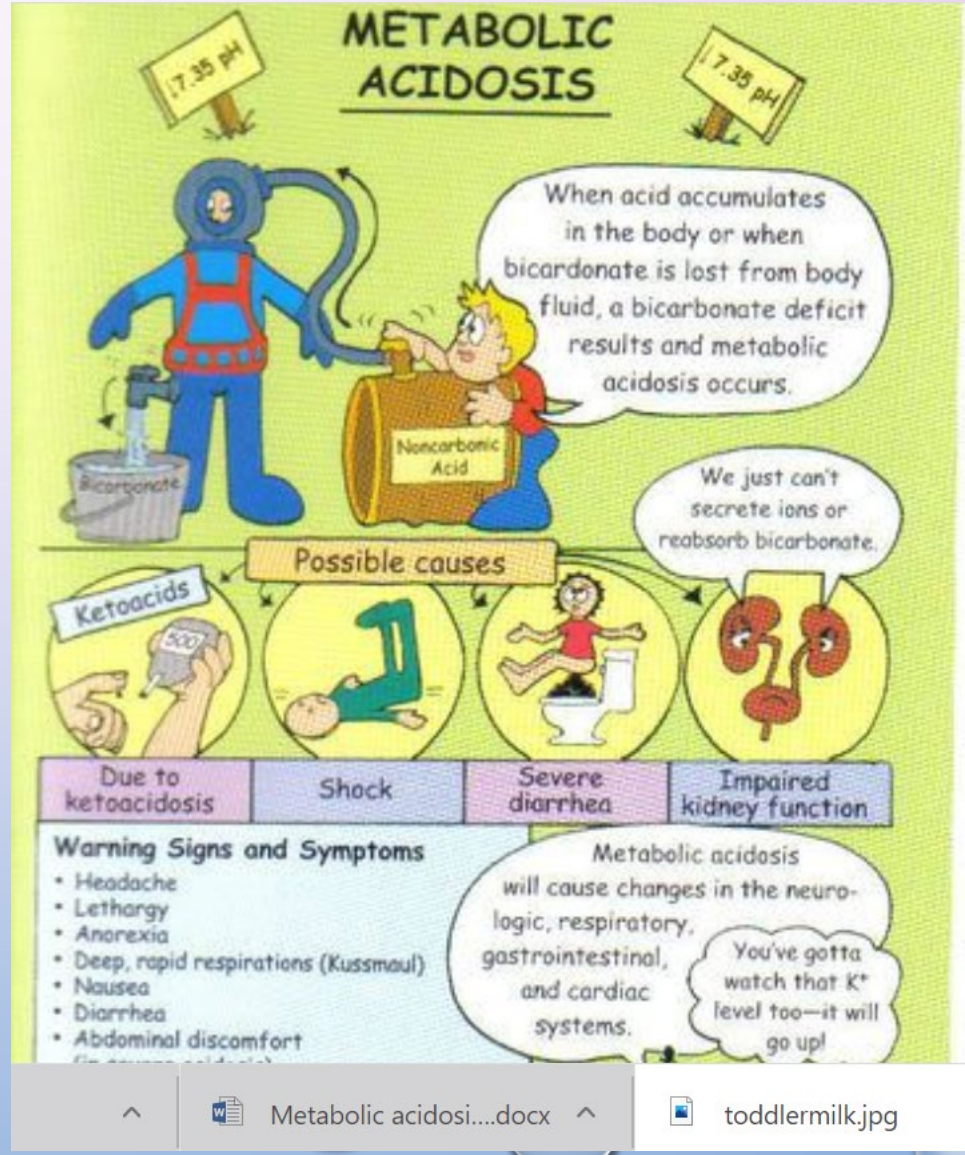
- CARBONIC ACID EXCESS
- CAUSED BY ANYTHING THAT INTERFERE WITH THE LUNGS ABILITY TO EXCRETE CARBON DIOXIDE (PNEUMONIA, MUSCULAR DYSTROPHY, SLEEP APNEA)

RESPIRATORY ALKALOSIS

- CARBONIC ACID DEFICIT
- CAUSED BY HYPERVENTILATION

METABOLIC ACIDOSIS

- EXCESS OF ANY ACID OTHER THAN CARBONIC
- CAUSED BY CELLS MAKING ACID THAT CAN'T BE EXCRETED (DKA, STARVATION), EATING ACID, OR LOSING BICARB



Metabolic acidosi....docx

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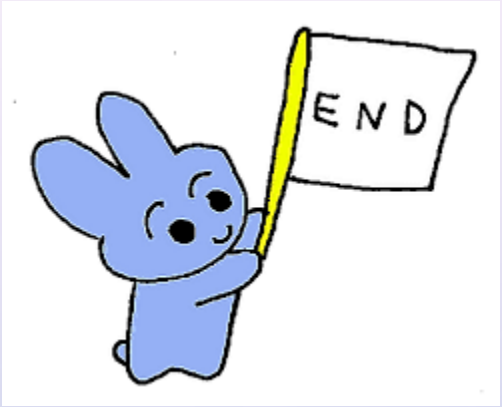
METABOLIC ALKALOSIS

- TOO FEW METABOLIC ACIDS
- CAUSED BY EXCESS INTAKE OF BICARBONATE OR EXCESS LOSS OF ACID THROUGH VOMITING (PYLORIC STENOSIS)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