Assessing Hydration in the Acute Care Adult Patient

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Learning Objectives

1) Recognize patients at risk for dehydration
2) Identify signs and symptoms of dehydration.
3) Develop strategies to prevent dehydration.

Case 1

- 43 y/o M adm. w/ sz & encephalopathy of unk. etiol
- Labs
  - Na - 136 / Cl - 101
  - K - 4.2
  - CO2 - 25
  - BUN – 42/Creat - 1.0 (***was 10/0.7 on admission 3 weeks prior***)
  - Glucose - 114
  - Calcium - 10.0
  - Phos - 4.4
  - Albumin – 4.1
- TF: 1.0 cal/mL @ 95 mL/hr via PEG/J (~ 2100mL)
- H2O flushes: 200 q 6 hrs (800mL)

Case 2

- 64 y/o F adm. to the ICU w/ sepsis of intraabdominal origin; N/V, abdominal pain, anasarca
- Labs
  - Na – 134 / Cl - 105
  - K - 3.2
  - CO2 - 19
  - BUN /Creat – 19/ 0.6
  - Glu - 102
  - Calcium – 7.3
  - Phos – 3.7
  - Albumin – 1.1
- Ht. 5' 4" Wt: 72kg UBW: 52kg

Case 3

- 52 y/o M adm. w/ active Crohn's
- PMH: relative SBS, oxalate renal stones
- Ht. 5'9" Wt: 136# UBW: 145#
- I & O:
  - 6-8 stools /day
  - 24 hour UOP = 800mL
- Labs
  - Na – 140 / Cl - 108
  - K – 4.0
  - CO2 - 18
  - BUN – 13 / Creat – 1.2
  - Glu - 92
  - Calcium – 8.6
  - Mg – 1.5
  - Phos – 2.9
  - Albumin – 4.6

Whose at Risk for Dehydration?

➔ All patients! ➔

Clinical Sequelae Associated with Dehydration[4,8,9,12]

- Urinary tract infections
- Pressure ulcers
- Confusion/ disorientation/ delirium
- Electrolyte imbalance/ hyperglycemia
- Respiratory infections
- Increase in falls
- Constipation
- Hypotension
- Increased mortality

Financial Costs[4,15,17,18]

- Patients admitted to acute care facilities with a diagnosis of dehydration = ~ 30% mortality.
- Annual cost of dehydration was $1.6 *billion* in 2010.
- In 2004, admissions for dehydration had ↑ to > 500,000 cases annually.
- Incidence of pts becoming dehydrated *after* admission to hospital ~ 3.5%

Dehydration[1,12,14]

- No absolute definition for dehydration exists.
- Does not manifest in a single form
- Hypovolemia & dehydration often used interchangeably.
- Many pts exhibit a combination of above
- Interviews w/ medical officers reveal no standard process for assessing dehydration.

Hypovolemia[5,6,16]

- Volume depletion = "perfusion deficit" or intravascular loss
  - Especially ICU patients
  - "Fluids as per primary team"
- Dehydration = intracellular loss

Signs of Dehydration[10]

- ↓ urination (< 1200mL/day)
- Dry mouth, sticky/thick saliva
- Poorly controlled diabetes
- Feeling tired all the time
- Urine looks dark in color
- Worsening kidney function
- Kidney stones
- Thirst!
- Rapid weight loss
- Stool output that is > intake

Be Alert for Excess Losses

- Burns
- Kinair beds[7]
- Fever (38-39° C – needs ↑'d by ~ 500 mL)
- Diaphoretic/ glistening skin
- Hot/dry environment
- Excessive drooling/ sialorrhea
  - Cerebral palsy, Down's syndrome, neuromuscular disorders such as ALS, head & neck cancers

Excess Losses cont.

- Gastric suction/ venting
- Percutaneous drains
  - Biliary / pancreatic / etc.
- Fistulas
  - Spit fistulas
  - Enterocutaneous
- Wounds/wound drainage
- Ostomies
- Chest tubes
- Open trach

Laboratory Assessment[10,12]

- Urine specific gravity - ↑ (> 1.030)
- Serum osmolarity - ↑, nl or ↓
- Serum sodium - ↑, nl, or ↓
- Hemoglobin / hematocrit - ↑
- Glucose - ↑
- BUN/creatinine ratio - ↑
- ***Elevated phosphorus***
- Elevated calcium

Blood Urea Nitrogen (BUN)

- Normal = 10-20 mg/dl
- Excreted by the kidney
  - < 10 mg/dl
    - Malnutrition, ⇓ protein intake, impaired urea cycle
  - > 20 mg/dl
    - Impaired renal flow—transient in most pts
      - Volume contraction
        - GI or other bleed/hematoma, ↑'d catabolism
      - Impaired vascular flow
        - CHF, hypotension, renal artery obstruction/stenosis

Serum Creatinine

- Normal = 0.7-1.1 mg/dl
- ***Actively secreted*** by the kidney
  - Remains stable until ***really dehydrated***
- < 0.7 mg/dl
  - Low muscle mass
- > 1.1 mg/dl
  - Renal failure/ intrinsic renal disease
  - Severe acidosis
  - Severe dehydration (> 5%)

Academy of Nutrition & Dietetics Evidence Analysis Library

- What is the best clinical and/or biochemical parameter for hydration status in the adult (19-64 years)?
- No single parameter is best in all adult populations.
- Findings
  - ***"In young, healthy active adults*** urine specific gravity, urine osmolality, serum osmolality, and urine color are good indicators of hydration status."
  - Body weight loss > 3%: good indicator of acute dehydration.
- Evidence - Grade II

Common Formulas Used To Determine Water Requirements[11]

FORMULAS	DESCRIPTION
Linear	30mL/kg BW (minimum, 1500 mL)
Adjusted	First 10 kg BW = 100mL/kg; next 10 kg BW = 50mL/kg; remaining kg BW = 20mL/kg
Alternatively written	1000mL for the first 10 kg BW + 500mL for the next 10 kg BW + 20mL per kg thereafter
Alternatively written	20mL(kg BW – 20) + 1500 mL
Harris Benedict	
Female	1mL/kcal; kcal = 655 + 9.6 wt + 1.85 ht – 4.7 age
Male	1mL/kcal; kcal = 66 + 13.8 wt + 5 ht – 6.8 age
Mifflin St Jeor	
Female	1mL/kcal; kcal = –161 + 9.99 wt + 6.25 ht – 4.92 age
Male	1mL/kcal; kcal = 5 + 9.99 wt + 6.25 ht – 4.92 age
National Research Council	
Female	1mL/kcal; kcal = 354 – 6.91 age + (9.36 wt × PA) + (726 ht × PA)
Male	1mL/kcal; kcal = 662 – 9.53 age + (15.91 wt × PA) + (540 ht × PA)

Formula Differences – 5 Sample Patients

Criteria	Examples				
Weight (kg)	42	75	110	85	150
Height (inches)	64	71	69	62	68
Age (years)	39	67	54	74	46
Physical Activity (1.2)	1.2	1.2	1.2	1.2	1.2
FORMULAS	**Est. mL / 24 hours**				
Linear	1260	2250	3300	2550	4500
Adjusted	1940	2600	3300	2800	4100
Harris Benedict					
Female	1176	1394	1781	1415	2198
Male	1193	1547	2093	1523	2687
Mifflin St Jeor					
Female	1083	1386	1768	1308	2191
Male	1249	1552	1934	1474	2357
National Research Council					
Female	1972	2305	2743	2169	3226
Male	2146	2624	3383	2600	4207

Water-Deficit Equation[2]

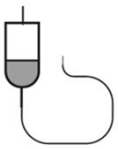
0.6 x patient's weight (kg) x (pts sodium/140 - 1)

⇒Water-deficit equation grossly underestimates:

- Total Body Water
- Free water losses

Components of Fluid Prescription[3]

- Maintenance requirements ➔ 75-125mL/hr (1800 – 3000mL /24 hours)
  - Supports:
    - Urine - 1200-2000
    - Feces - 100
    - Skin / Lungs – 500-800mL



- Replacement of deficits
- Ongoing Losses
- Reevaluate as clinical status changes

What Makes Sense for Your Patient?

- What are we treating? (volume vs. hydration?
- What are their losses?
- 24 hour urine output?
- Normal kidney function?
- Cardiac issues?
  - CHF?
    - Is pt receiving 80mg of Lasix a day?
- Bleed of any kind?
- Hyperglycemic?
- Can the pt get a drink if thirsty?

Makes Sense cont.

- What are the current fluid sources?
  - Any oral intake, IVs, enteral, IV antibiotics?
  - ? ***Receiving*** prescribed water flushes & EN ?
    - If pt on cycled EN and pump is programmed to give automatic flushes, pt ***will not*** receive flushes when pump turned off.
- IVs off, starting EN…
  - Are they adequately hydrated now?
    - If pt is behind, even though current regimen may be appropriate, must make up for existing deficits

Hydration - Strategies

- Oral – can they drink more?
- Enteral
  - ↑ water flush volume or frequency
  - Open system--dilute TF & infuse water w/ TF
    - Provide specifics to nursing—NOT "give ¾ strength," but, "add 80mL water to each can TF and infuse @ ___ mL/hr"
  - If pt on cycled TF, hang 500-1000mL of water and run in over 3-6 hours during time off

Strategies cont.

- Home pts: have pts measure out set volume of water every morning (see next slide).
- Use water from container over the day for med & water flushes; ***ALL*** needs to be used before bed.
  - If they need kcal AND water, but can't handle more volume, have them split water flushes as half water & half fruit juice
    - Example: pt needs 1000mL water daily in addition to TF; give: 500mL cranberry juice mixed with 500mL water
      - Adds ~ 275 kcal/day

Provide Containers & Demonstrate Volume Needed Daily…

Strategies cont.

- Normal kidneys, non-communicative pt:
  - ↑ water flushes
  - Trial of 1-2 liter IV fluid challenge of *hydrating fluid*
  - If BUN exceeds 20, give 1 liter of ½ normal saline, D5, etc. over 4-5 hours, etc.

Planning for Home: Strategies

- Stop IV fluids as soon as feasible
  - Ideally 48 hours prior to discharge to ***"mimic home plan."***
- Advise pts that if they are thirsty, urine is dark, or urine volume is < normal, they may need more water.
- If venting gastric secretions/have external drains, may need to replace
  - ½ normal saline = ¾ teaspoon salt per liter water

Electrolyte Content of IV Solutions/L[3]

FLUID	Na mEq/L	K mEq/L	Glucose g/L	mOsm/ L
0.9 NS	154	0	0	308
0.45 NS	77	0	0	154
0.25 NS	38	0	0	77
Lactated Ringers (LR)	130	4	0	280
D_5W	0	0	50	252
D_5W 0.45 NS	77	0	50	400
0.9 NS + 150 mEq NaHCO3	308	0	0	616
3% saline	513	0	0	1025

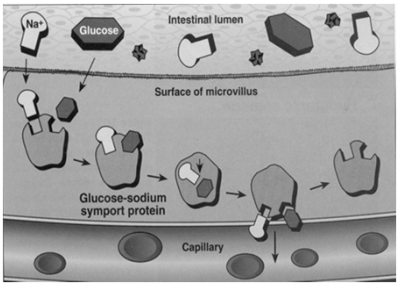
Oral Rehydration Therapy (ORT)[9,18-20]

- Diarrheal illness and dehydration claim 1.5-2.0 million children each year.
- Use of ORT has reduced child deaths due to diarrheal illness from:
  - ➢4.6 million in 1980 to 1.3 million in 2008
  - ➢Isotonic solution of salt, water, glucose
  - ➢Ratio of Na+:glucose = 1.0:1.0-1.4

Mechanisms of Water Movement

- Passive absorption
- Active absorption
  - Via sodium-potassium ATP pump
- Glucose-coupled transport (ORT pathway)
  - Primarily in the jejunum
  - Coupling is obligatory
  - Permits absorption of 1 Na & 1 glucose molecule
  - Coupled transport is uni-directional

Sodium-glucose Transporter



Potential Uses

- Short bowel syndrome
- Increased ostomy losses
- Diarrhea associated with HIV
- Salt-wasting nephropathies
- Infectious diarrheas
- Any diarrhea that prevents hydration with "normal" fluids

Practical Concerns

- Palatability
- Volume needed
- Does not eliminate diarrhea
- Concurrent enteral nutrients are important
- Cost

simply delicious

Hmmm.

Take Home Message

- Dehydration is a serious problem
- Time/energy spent on calculations may be better spent on strategies to get fluids in consistently.
- Consider: how many pts are admitted with fluid overload?
- Put the pieces together and be systematic & logical in your assessment