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Defining, Managing, and Troubleshooting High Ileostomy Output

Disclosures: Drs. Chessman and Jump have no commercial relationships relevant to the topic being presented.

Presentation Overview/Summary

- The management of a patient with a high-output stoma can be challenging. During this presentation, GI physiology and the management of high-output stoma will be discussed. Issues related to supportive measures, such as appropriate fluid, electrolyte, and drug therapy will be reviewed using illustrative cases.
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Learning Objectives

1. Describe conditions that may require ileostomy and define high ileostomy output
2. Evaluate changes in physiology that accompany ileostomy
3. Discuss nutritional management and pharmacologic management of high ileostomy output.
4. Solve challenging cases illustrating interventions

At the end of the presentation, the learner will be able to:

1. Describe the most common electrolyte abnormalities seen with high ileostomy output.
2. Choose a medication regimen that may help decrease ileostomy output.
3. Understand why certain enteral fluids and formula choices are made for patients with high ostomy output.

Key Takeaways/Fast Facts

- Assessment of urine sodium may be helpful to determine overall fluid (and sodium) balance of a patient with a high-output stoma.
- Higher dosages of commonly used medications (e.g., loperamide, ranitidine, omeprazole, sodium citrate) are often needed in patients with high-output stomas.
- Diet is critical in patients with high-output stomas and must be individualized based on remnant anatomy. In general, small, frequent meals rich in complex carbohydrates (low in disaccharides) and fats with essential fatty acids are preferred. For infants, human milk is preferred; formula selection depends on remnant bowel.

Learning Assessment Questions

1. Compared to the electrolyte content of diarrhea, ileostomy output typically has a higher concentration of:
    A. Chloride
    B. Potassium
    C. Zinc
    D. Sodium

2. How does gastric acid contribute to high ostomy output?
    A. Adds to luminal fluid content
    B. Denatures pancreatic enzymes
    C. Denatures bile salts
    D. All of the above

3. In patients with high ileostomy output, you may want to consider the use of liquid or IV formulations of medications over capsules or tablets in effort to increase absorption:
    A. True
    B. False

4. Which is true regarding loperamide use in patient with high-output stomas?
    A. The maximum daily dose is 16 mg.
    B. Sedation generally limits the doses that can be used.
    C. Initially, doses should be administered 30-60 minutes before meals.
    D. Use is contraindicated in infants younger than 1 year of age,

5. Solutions which may be used for fluid and electrolyte replacement in patients with high-output stomas include all BUT which of the following?
    A. Gatorade Prime®
    B. Gatorade G2® with ¾ tsp salt per 32 oz
    C. Pedialyte®
    D. Drip Drop®

Learning Assessment Answers:

1. **Answer: D.** The sodium content of ileostomy output can be 135 mEq/L or more. Jejunostomy output may be higher. Measuring electrolytes in the output may help determine electrolyte needs. Consider a 'spot' urine Na or a FeNa to assess total body sodium. Hyponatremia is a late finding of sodium depletion; patients with normal serum sodium can be sodium depleted, which can contribute to poor growth, especially in children.
2. **Answer: D.** Gastric acid can contribute to high stoma output by adding to luminal fluid content, and by causing malabsorption through denaturation of both pancreatic enzymes and bile salts. Acid blockade, usually with a proton pump inhibitor, is a commonly prescribed in patients with a high-output stoma.
3. **Answer: A.** Liquid formulations may allow for better absorption of medication over capsules and tablets when there is rapid transit through the GI tract. When the medication allows, the patient should take with minimal fluid and avoid mealtime which can stimulate motility and increase output. Each medication should be considered individually; for example, loperamide liquid (1 mg/5 mL) contains sorbitol, so opening capsules or using the 1 mg/7.5 mL concentration which is sorbitol-free would be preferred.
4. **Answer: C.** High loperamide doses are often needed and well tolerated in patients older than 1 month of age with high output stomas. Because of the gastrocolic reflex associated with eating, loperamide administration before meals may be more effective.
5. **Answer: A.** Both Pedialyte® and Drip Drop® contain sodium and a small amount of glucose to replace losses. Gatorade G2® does not have enough sodium but can be improved by adding table salt. Gatorade Prime® contains more sodium but a significant amount of sugar. Sugary drinks should be avoided.

Selected References

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Definitions of high output: 1-2 L/fluid in 24 hours, 1200-1500 mL, or >20-50 ml/kg/day
Differential Dx: GI infection (SBBO), prokinetics, abrupt discontinuation of corticosteroid, metformin, bowel obstruction, abdominal sepsis, IBD, high sugar diet

Electrolyte Content of Body Fluid (varies based on maturity of stoma)

Fluid	**Na^+ (mEq/L)**	**K^+ (mEq/L)**	**Cl^- (mEq/L)**	**Bicarbonate**
Gastric	20-100	5-20	100-150	0
Pancreatic	120-140	5-15	75-120	90
Small bowel	100-140	5-15	90-130	10-50
Bile	120-140	5-15	80-120	40-50
Ileostomy	45-135	3-15	20-115	30
Diarrhea	10-130	10-90	10-110	0

* Gold standard for rehydration solutions. ** Other forms available; sugar-free Gatorade available.

Enteral/Oral Hydration Solutions (examples only)						
Product	**Na^+ (mEq/L)**	**K^+ (mEq/L)**	**Cl^- (mEq/L)**	**Base (mEq/L)**	**CHO (g/L)**	**Osm (mOsm/L)**
Rehydration Solutions – replace fluid deficits						
***WHO (Unicef)**	90	19.2	21	30	13.5	333
Bana Serious	68.6	10.3			2	
Bana Better (for kids)	51.4	5.1			2	
Ceralyte 70 (packets)	70	20	60	30 (citrate)	40 (rice)	< 260
Ceralyte 90 (packets)	90	20	80	30 (citrate)	40 (rice)	< 275
Drip Drop Solution	60	20	8	80 (citrate)	16	< 200
Maintenance Solutions – prevent fluid deficits						
Pedialyte, including Pedialyte Popsicles	45	20	35	30	25	388
Ceralyte 50 (packets)	50	20	40	30 (citrate)	40 (rice)	< 260
Enfalyte	50	20	40	30	20	251
Sports Drinks (for illustration only – <u>NOT</u> a rehydration solution)						
Gatorade (G2)**	20	3.2	17	30	21	305
Gatorade Prime**	40.5	7.6	17	30	195	305

<u>Sodium chloride</u>
Table salt: 1 tsp salt = 6 g salt ≈ 2,400 mg sodium = **104** mmol sodium = **104 mEq** sodium
Sodium chloride tablets: 1 g tablet = 17 mEq Na
23.4% NaCl for injection: 1 mL = 4 mEq Na

<u>Sodium with citrate or bicarbonate (see table below)</u>
Sodium citrate/citric acid (Bicitra, Cytra-2): 1 mL = 1 mEq Na and 1 mEq bicarbonate equivalent
Sodium/potassium citrate/citric acid (Polycitra, Cytra-3): 1 mL = 1 mEq Na, 1 mEq K, 2 mEq bicarb equivalent
Potassium citrate/citric acid (Polycitra K): 1 mL = 2 mEq K and 2 mEq bicarbonate equivalent
Na bicarbonate tablets: 650 mg tablet = 7.7 mEq Na and 7.7 mEq bicarbonate

Medications Used in Patients with High Output Ileostomies (examples only)			
Type	**Example**	**Pediatric Dosing (Adult Dosing)**	**Notes**
Acid suppression H_2RA PPI	 Ranitidine Omeprazole	 10-20 mg/kg/d (300-600 mg/d) 0.5-1 mg/kg/d (40 mg/d)	Consider IV or liquid formulation; watch for sorbitol/sugar in preparation
Oral antibiotics SBBO	Metronidazole Amoxicillin/clavulanate Rifaximin Gentamicin Neomycin Ciprofloxacin	10 mg/kg q8-12h (250, 500 mg) 20-25 mg/kg q12h (500 mg) 200 mg TID (400 mg) 50 mg/kg/d TID (80 mg) 50 mg/kg/d TID-QID (500 mg) 10 mg/kg BID (250 mg)	Monitor liver function >3 years old Resistance
Alkalinizing agent	See above	1 – 2 mEq bicarbonate equivalent/kg/day; advanced to dose needed for normal electrolytes	Dose based on electrolyte values and ostomy losses
Fiber, soluble	Guar gum (Benefiber) Pectin (Certo)	3-4 g (1 Tbsp) / 4 oz formula 1 tsp / 4 oz formula	Amount and frequency depends on ostomy output
Bile acid sequestrant	Cholestyramine (Questran Light)	240 mg/kg/day in divided doses	Caution with fat soluble vitamins
Anti-motility agents	Loperamide (Imodium)	Initial: 0.08 – 0.24 mg/kg/day divided q4-24 hr (2 -4 mg) Chronic: 0.4 – 1.5 mg/kg/day (2-16 mg); very high doses have been used	Abuse potential 1 mg/5 mL liquid contains sorbitol
Somatostatin analogue	Octreotide	IV infusion Daily subcutaneous depot Monthly intramuscular	Cholelithiasis, hyperglycemia
GLP-2 analogue	Teduglutide	Daily injection	Adults with SBS

Minerals/vitamins: vitamin A, D, E, K, folic acid, and B_{12}; magnesium, zinc, and copper

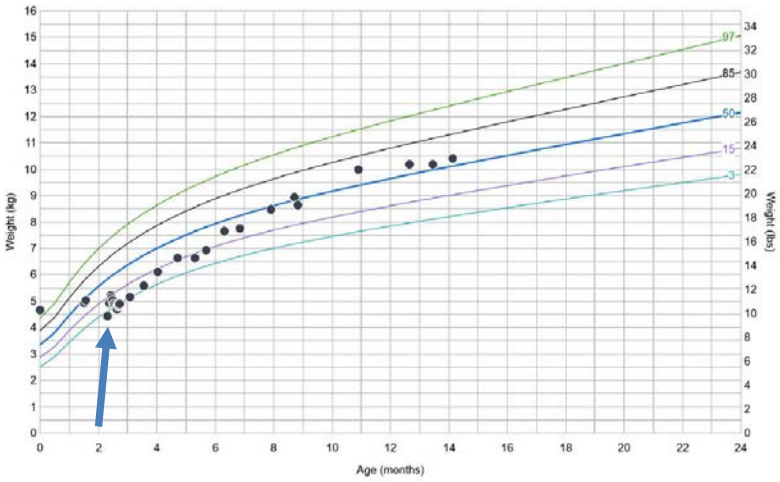
Consider PN/IV fluid weaning when:

- Family is familiar with disease, anatomy, diet
- Receiving 80% of daily energy requirements through oral/enteral nutrition while maintaining body weight with stable electrolytes
- Urine production 0.5- 1 ml/kg/day (40-50 mL/hr) on PN/IV free nights
- Enteral balance should be POSITIVE between 500-1000 ml for the day

Case #1

A 2-month-old (weight, 4.2 kg) with total colonic Hirschsprung's disease is s/p total colectomy and ileostomy formation approximately 20 cm from the ileocecal valve. He is receiving maternal breast milk fortified to 22 kcal/oz with Alimentum® powder 60 mL every 3 hours. In the past week, his ostomy output has ranged from 50 – 60 mL/kg/day. His medications include: cholecalciferol 400 units daily; ranitidine 10.5 mg PO BID (2.5 mg/kg/dose)

Date	Urine Na	Urine Cr	Urine Osm	Serum Na	Serum HCO_3
3/7	**< 20**			**134**	**15**
3/9	**< 20**			**138**	
3/11	**55**			**137**	
3/22	**75**			**139**	
4/5	**60**			**136**	**19**
9/17	**< 20**	**77.2**	**727**	**129**	**19**
9/21	**90**			**138**	**21**



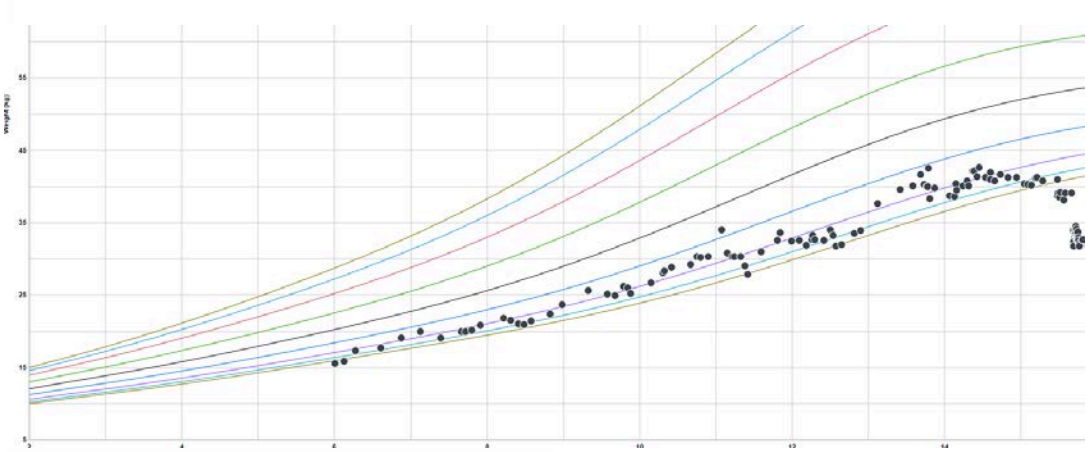
Questions for discussion

1) Should the infant's nutrition regimen be changed?
2) What does the urine sodium tell you about this patient? What would be the best approach to addressing his sodium deficit?
3) What medications would be appropriate to add to this infant's regimen?
4) When should we suspect / treat for small bowel bacterial overgrowth?
5) What monitoring should be done?

Case #2

Patient is a 16-year-old female with pancreatic insufficient CF, type 1 DM, and a history of complicated meconium ileus. She is s/p resection of 75 cm of small bowel. with temporary ileostomy and subsequent take-down in infancy followed by fulminant *C. difficile* colitis requiring total colectomy with end ileostomy at 15 years of age. After colectomy, she was on PN for approximately 1 month and then discharged on a regular diet, enteral feeds of Peptamen Jr® at 115 ml/hr for 20 hr/day. She was using Creon® with meals and Relizorb® with overnight feeds. She was also on dronabinol for appetite stimulation, ondansetron for nausea, ranitidine, and loperamide.

She presents to clinic with poor weight gain and dehydration. She states she has been compliant with above regimen but 'everything goes right through her'. She is unable to quantify her output beyond stating that she empties her at least ½ full ostomy bag 4-5 times per day. She is admitted for hydration, nutritional rehabilitation, and IV antibiotics related to CF exacerbation.



Weight: 32.8 kg (72 lb 5 oz) (0 %*, Z = -4.44)
Height: 150.2 cm (4' 11.13") (3 %*, Z = -1.90)
BMI: 0%ile (Z=-3.29)
* Growth percentiles are based on CDC 2-20 Years data.

Labs significant for:
WBC 23., Hg 13.7, MCV 81, Plts 381
Na 125, K 3.0, BUN 21, Cr 0.9, Cl 70, CO_2 40, glucose 228, alb 2.9, ALT 82/AST 62, Alk Phos 631
C. difficile: negative, CRP 7.43, UNa <20, Zinc 95

Discussion Questions:

1) From an intestinal physiology standpoint, should this patient require long term PN? What are some of her poor prognostic indicators?
2) Without the presence of enteral nutrition, would this patient be a 'net secretor'? What is the normal net fluid loss/gain in the intestinal tract?
3) What is the role of acid suppression in this patient and how can we increase efficacy of these (and other) medications?
4) What is the indication to do a urine Na in these patients?
5) How does the use of PERT complicate things in this patient?
6) Is there a role for octreotide or teduglutide in this patient?