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Tummy Ache, Vomiting, Diarrhea, Oh My! Pediatric Gastroenteritis

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Disclosures

- None

Learning Objectives

- Review the incidence of Acute Gastroenteritis (AGE) in United States
- Review the pathogens associated with childhood AGE
- Identify the signs and symptoms of severe AGE and dehydration
- Identify red flags for serious illness
- Learn new updates regarding the treatment of childhood AGE
- And…..have fun!

Incidence

- Acute Gastroenteritis (AGE): diarrheal disease with rapid onset, with or without nausea, vomiting, fever or abdominal pain.
- Per year for children, approximately
  - 1.5 million outpatient visits
  - 200,000 hospitalizations (9% of all hospitalized admissions for children under 5 years old)
  - 300 deaths

Pathophysiology of diarrhea

- Osmotic
  - Injury to villi of brush boarder in small intestine
  - Malabsorption
  - Osmotic diarrhea
  - Rotavirus
- Secretory
  - Toxins bind to enterocyte receptors
  - Release of Cl ions into lumen
  - Secretory diarrhea
  - Cholera

	Pathogen	Preferred treatment in children
Viruses: 70-80%	Rotavirus	Vaccine (available again)
	Adenovirus	
	Others: Norwalk, Calcivirus, Astrovirus, Parvovirus	
Bacteria: 10-20%	Salmonella	Cefotaxime, ceftriaxone (Only treat if less than 3 months, bacteremia or risk factors)
	Shigella	Cefotaxime, cetriaxone, ciprofloxacin
	Campylobacter	Erythromycin, azithromycin, ciprofloxacin
	Yersinia	TMP-SMX, tetracycline, doxycycline
	E.coli (primarily enterohemorrhagic, 0157:H7)	NO ABX (increases risk of HUS) (Wong 2003)
	Clostridium difficile	Metronidazole (avoid vancomycin for concerns of resistance (AAP 2003)
Parasites: 0-10%	Giardia Lamblia	Metronidazole or nitazoxanide
	Cryptosporidium	Metronidazole or nitazoxanide

Case 1: Telephone Call

- The phone call
  - 38 year old mother who is educated and competent. You care for the entire family and know them well.
  - 3 year old with vomiting during school x1. Ate dinner and vomited immediately after. Now calling for advice or need to go to ER.

Case 1: Telephone Call

- Identify caller
- Document the call
- Assess comfort level of caregiver
- Assess clinical status of child
- Give Instructions
- Have caregiver repeat instructions
- Establish follow-up plans

BOX 1. Indications for medical evaluation of children with acute diarrhea

- Young age (e.g., aged <6 months or weight <8 kg)
- History of premature birth, chronic medical conditions, or concurrent illness
- Fever ≥38°C for infants aged <3 months or ≥39°C for children aged 3–36 months
- Visible blood in stool
- High output, including frequent and substantial volumes of diarrhea
- Persistent vomiting
- Caregiver's report of signs consistent with dehydration (e.g., sunken eyes or decreased tears, dry mucous membranes, or decreased urine output)
- Change in mental status (e.g., irritability, apathy, or lethargy)
- Suboptimal response to oral rehydration therapy already administered or inability of the caregiver to administer oral rehydration therapy

King CK, Glass R, Bresee JS, Duggan C. Managing Acute Gastroenteritis Among Children Oral Rehydration, Maintenance, and Nutritional Therapy. Morbidity and Mortality Weekly Report (MMWR) 2003; 52 (RR-16), MMWR available at http://www.cdc.gov/mmwr/PDF/rr/rr5216.pdf

Case 1: Telephone Call

- 3 year old.
- Vomiting solids x2
- Previously healthy
- No fever
- No bilious vomiting
- No abdominal pain
- Tolerating liquids
- Normal activity

- Recommended
  - Small frequent feeding (Wan 1999, Santosham 1985)
  - Continue usual diet (Brown 1994, Fayad 1993, Alarcon 1992)
- Not recommended
  - BRAT diet (unless part of usual diet) (King 2003)
  - Clear liquids (opposed to oral rehydration solution) (King 2003)
  - Lactose-free diets (unless history or suspicion) (Brown 1994)
  - Dilution of milk or formula (Brown 1994)

Case 2: Initial Office Assessment

- Family Medicine Office
- 9 yo previously healthy
- “Can’t keep anything down”
- What other questions would you like to ask?

Case 2: Initial Office Assessment

- What other questions would you like to ask?
- Questions should address:
  - Intake
  - Output (ongoing losses)
  - Source of infection
  - Severity of dehydration

Case 2: Initial Office Assessment

- H&P is key to diagnosis (Cincinnati 2006)
- Determine the presence and severity of dehydration first (Steiner 2004)
- Change in body weight is gold standard but often impractical (Gorelick 1997, Duggan 1996)

Case 2: Initial Office Assessment

- Best predictors

  (Steiner 2004, Gorelick 1997)
  - Prolonged cap refill
  - Abnormal skin turgor
  - Absent tears
- Two of following yields LR of 6.1 (Gorelick 1997)
  - Cap refill
  - Dry membranes
  - Absence of tears
  - Abnormal overall appear.

Appendix 2 Physical parameters associated with degree of dehydration

Parameter	Normal to Mild (<6%)	Mild to Moderate (6 to 9%)	Severe (>9%)
MUCOUS MEMBRANES	Slightly dry	Dry	Dry
EXTREMITIES	Warm, good refill	Delayed refill	Mottled, poor refill
TEARS	Normal	Normal to absent	Absent
MENTAL STATUS	Normal	Normal to listless	Normal to coma
Blood pressure	Normal	Normal	Normal/decrease
Pulse "quality"	Normal	Normal/ decrease	Moderate decrease
Heart rate	Normal	Increased	Increase or decrease
Skin turgor	Normal	Decreased	Decreased
Fontanel	Normal	Sunken	Sunken
Eyes	Normal	Sunken	Deeply sunken
Urine output	Slight decrease	< 1ml/kg/hr	<< 1ml/kg/hr
Thirst	Slight increase	Moderate increase	May be unresponsive

Cincinnati Children's Hospital Medical Center. Evidence-based clinical care guideline for acute gastroenteritis (AGE) in children aged 2 months through 5 years. Cincinnati (OH): Cincinnati Children's Hospital Medical Center; 2006 May.

Case 2: Initial Office Assessment

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•Oral Rehydration Solution
•Usual Diet

Case 2: Return Visit to Office

- 9 year old now with 2 days of diarrhea (after 2 days of vomiting, which has now resolved)
- Taking both solids and liquids
- Physical exam is unchanged

Case 2: Return Visit to Office

- Mild to no dehydration
- Recommended:
  - Regular Diet (low in sugar) (King 2003)
  - Consider Zinc supplementation (King 2003)
  - Consider Probiotics (Kligler 2007)
- Not recommended
  - Routine labs (King 2003, Cincinnati 2006, Steiner 2004)
  - Routine cultures (unless bloody, immunocompromised, suspected exposure or local outbreak) (King 2003, Cincinnati 2006)
  - Loperamide, opiates, anticholinergics, Bismuth subsalicylates, adsorbents (fiber, charcoal), antibiotics (AAP 1996, King 2003, Kligler 2007)
  - Gatorade, soda, apple juice (King 2003, Cincinnati 2006)

Case 3: ER assessment

- 6 year old with vomiting for 2 days, and now diarrhea with abdominal cramping
- No solid intake for two days
- Decreased liquid intake
- Decreased activity and urine output for last 6 hours

Case 3: ER assessment

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- Dry mucous membranes
- Delayed capillary refill
- Urine less than 1 ml/kg/hr

Case 3: ER assessment

- Moderate dehydration
- Recommended:
  - Estimate amount of dehydration and ongoing losses (Steiner 2004)
  - Oral rehydration (50-100 ml/kg) 4-6 hrs (Cincinnati 2006)
  - Consider Ondanseterone (Cincinnati 2006, Decamp 2008)
  - Start feeding immediately
  - Consider probiotics (Kligler 2007, Cincinnati 2006)
- Not recommended:
  - NPO (Cincinnati 2006, King 2003)
  - ½ strength formula (Brown 1994)
  - Routine labs (unless require NGT or IVF) (Steiner 2004)
  - Lactose-free diet (unless history or high clinical suspicion) (King 2003)

Case 3: ER Progression

- Moderate dehydration, not tolerating PO
- Recommended:
  - IVF or Oral rehydration via NGT (4-6 hrs) (Cincinnati 2006)
  - Labs (Steiner 2004): serum electrolytes
  - Consider Ondanseterone (Cincinnati 2006, Decamp 2008)
  - Start feeding when able and rehydrated (Cincinnati 2006)
  - Consider probiotics (Kligler 2007, Cincinnati 2006)
- Not recommended:
  - NPO (Cincinnati 2006, King 2003)
  - Anti-diarrheal medications (King 2003)

Case 3: ER Progression

- Moderate dehydration resolved
- Now alert and active
- Recommended discharge if: (Cincinnati 2006)
  - Sufficient rehydration achieved
  - IVF/NGT not required
  - Oral intake exceeds losses
  - Education done
  - Follow up is available

Case 4: Infant

- 3 week old with vomiting and diarrhea since the morning. No fever, lethargy, or decreased breast feeding. Unable to ascertain number of wet diapers (urine is mixed with stool). Sibling with rotavirus positive AGE.
- Clinically well looking. Moist mucosa, active, AFOF.

Case 4: Infant

- Mild to no dehydration
- Recommended
  - If breastfed, continue (King 2003)
  - If formula-fed, continue (King 2003)
  - ?formula with soy fiber (King 2003)
  - Very close follow up
  - Probiotics (Kligler 2007)
- Not Recommended
  - Diluting formula (King 2003)
  - Lactose-free formula (King 2003)

Case 5: Zebra

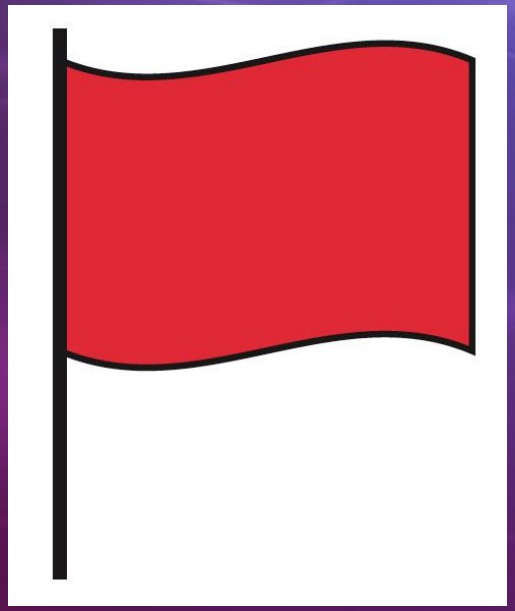
- 15 month with vomiting, fever, distended abdomen.
- Lives with multiple extended relatives from Mexico in one bedroom apartment. One relative has fever, night sweats, cough, and weight loss. Family has been importing non-pasturized cheese from Mexico.
- Hospital course
  - Abdominal CT negative. Galium scan with increased uptake in lower abdomen.
  - PPD 8 mm
  - Started on anti-TB meds
  - Cultures later grew Mycobacterium Bovis

Case 5: Zebra

- Other Zebras may include
  - Bacterial AGE
  - Appendicitis
  - Celiac disease
  - Pneumonia
  - UTI
  - Lactase insufficiency
  - Inflammatory Bowel Disease
- Consider expanding differential diagnosis, workup and treatment when red flags are present

Red Flags

- Young age
- Toxic appearance
- Signs of severe dehydration
- Associated signs/symptoms
  - High fever
  - Bilious or bloody vomiting
  - Bloody stools
  - Severe abdominal pain
  - Weight loss
  - Jaundice
  - Anasarca
  - Altered Mental Status
- Prolonged course
- Poor improvement despite treatment



Red flags may warrant more aggressive workup and treatment.

Take home points

Not Recommended

- Routine labs and cultures
- BRAT Diet
- Clear liquids alone
  (as opposed to ORT)
- Lactose-free diets (unless history or suspicion)
- Dilution of milk or formula
- Gatorade, soda or juice
- Antispasmodic, anti-diarrheal or antibiotics medications

Take home points

Recommended

- History and Physical
- Consider labs for only those requiring IV or NGT feeds
- Consider cultures for only those with bloody diarrhea or suspected exposure
- Oral Rehydration for mild to moderate dehydration
- Early introduction of usual diet
- Consider Zinc, probiotics for outpatient use
- Consider ondanseterone for ER or inpatient use
- Close follow-up
- Children with red flags require more aggressive workup and treatment

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Any Questions?

Thank You.

Extra slides (in case asked)

Oral Rehydration Solutions

	CHO (gm)	Na (mEq/L)	K (mEq/L)	Osmolarity
Pedialyte	25	45	20	250
WHO-ORS	20	90	20	330
Cola	126	2	0.1	750
Apple Juice	125	3	32	730
Gatorade	59	20	3	330

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Homemade ORS

- http://www.pamf.org/patients/ors.html
- 1 Liter Water
- ½ tsp table salt
- ½ tsp baking soda
- 8 tsps of sugar (or 2 tsps Karo Syrup)
- ¼ tsp of salt substitute (potassium)

- www.rehydrate.org
- 1 Liter Water
- 1 tsp salt
- 8 tsps sugar