Work up And Management of Acute Diarrhea

Tauseef Ali MD, FACP, FACG

Clinical Assistant Professor of Medicine
University of Oklahoma Health Sciences Center
Adjunct Clinical Assistant Professor of Medicine
Oklahoma State University
Director Crohn’s and Colitis Program
Saint Anthony Hospital, Oklahoma City

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Objectives

• Defining the diarrhea in clinical practice
• Understanding the pathophysiology of acute diarrhea
• Reviewing the different causes of acute diarrhea
• Reviewing the medical management of acute diarrhea
• Reviewing the Traveler’s diarrhea
Defining Diarrhea

Acute Diarrhea
3 or more liquid or watery stools in 24 hours

Persistent Diarrhea
Diarrhea lasting for 14 days or more

Chronic Diarrhea
Diarrhea lasting for 30 days or more
Defining Diarrhea

• WHO Definition
  ✓ Diarrhea is the passage of 3 or more loose or liquid stools per day, or more frequently than is normal for the individual

• Bristol Scale Definition
  ✓ type 5, 6 and 7 on the Bristol Stool Chart
Defining Diarrhea

Osmotic Diarrhea
Too much water is drawn into the bowels
*Osmotic laxatives*

Secretary Diarrhea
An increase in the active secretion, or there is an inhibition of absorption
*Cholera toxin*
## Defining Diarrhea in your Digital Practice

<table>
<thead>
<tr>
<th>Diarrhea</th>
<th>ICD 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>R19.7</td>
</tr>
<tr>
<td>Infectious diarrhea</td>
<td>A09</td>
</tr>
<tr>
<td>Travelers diarrhea</td>
<td></td>
</tr>
<tr>
<td>Infectious gastroenteritis and colitis, unspecified</td>
<td></td>
</tr>
<tr>
<td>Non infective gastroenteritis and colitis, unspecified</td>
<td>K52.9</td>
</tr>
<tr>
<td>Diarrhea due to allergies</td>
<td>K52.2</td>
</tr>
</tbody>
</table>
### Defining Diarrhea in your Digital Practice

<table>
<thead>
<tr>
<th>Diarrhea</th>
<th>ICD 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clostridium Difficile</td>
<td>A04.7</td>
</tr>
<tr>
<td>Campylobacter</td>
<td>A04.5</td>
</tr>
<tr>
<td>Salmonella</td>
<td>A02.0</td>
</tr>
<tr>
<td>Protozoa</td>
<td>A07.9</td>
</tr>
<tr>
<td>Viral</td>
<td>A08.4</td>
</tr>
</tbody>
</table>
Epidemiology

- Over 3.5 million outpatient visits each year

<table>
<thead>
<tr>
<th>Non-food borne gastroenteritis</th>
<th>Food borne gastroenteritis</th>
<th>Water borne gastroenteritis</th>
</tr>
</thead>
<tbody>
<tr>
<td>135 million cases per year</td>
<td>76 million cases per year</td>
<td>Treated water – cryptosporidium</td>
</tr>
<tr>
<td></td>
<td>325,000 hospitalizations</td>
<td>Fresh water – E coli and norovirus</td>
</tr>
<tr>
<td></td>
<td>5000 deaths each year</td>
<td></td>
</tr>
</tbody>
</table>

Cost of Diarrhea

Mortality

300-400 deaths among children

Financial

$1 billion direct medical cost

Work loss

Medical co-morbidities

IBS

Ankylosing spondylitis

Renal failure
How do we get it!
The Amazing Intestines

- **10 liters** of ingested fluid and secretion enter the intestine daily
- **90%** absorbed in small intestine
- **90%** of remaining fluid (800-1000ml) absorbed in colon
- **80-100 ml** fluid in stool daily
Ingest water

Saliva 1500 mL/day

Gastric secretions 2500 mL/day

Bile 500 mL/day

Pancreatic juices 1500 mL/day

Intestinal secretions 1000 mL/day

Small intestine absorbs 7000 mL/day

Colon absorbs 1900 mL/day

Water excreted

Koeppen & Stanton: Berne and Levy Physiology, 6th Edition, Copyright © 2008 by Mosby, an imprint of Elsevier, Inc. All rights reserved
Mechanisms of Diarrhea

- Osmotic diarrhea
- Secretory Diarrhea
- Inflammatory
- Malabsorption
- Altered bowel motility
- Miscellaneous
Pathophysiology of Osmotic Diarrhea

Non absorbable substance

Water movement follows solute movement by osmosis
Characteristics of Osmotic Diarrhea

- Moderate volume of stool
- Improves/disappears when oral intake stops
- Moderately watery/soft stool
- Often associated with increased flatus if due to carbohydrate malabsorption
- No WBC or RBC in stool
Causes of Osmotic Diarrhea

• **Medications**
  • Laxatives (Mg, SO4, PO4), lactulose

• **Undigested sugars:**
  • Diet foods/drinks/gum (sorbitol, mannitol, others)
  • Enzyme dysfunction (e.g. lactase deficiency)
Mechanisms of Diarrhea

• Osmotic diarrhea
• Secretory Diarrhea
• Inflammatory
• Malabsorption
• Altered bowel motility
• Miscellaneous
Pathophysiology of Secretory Diarrhea

Massive volume of plasma-like fluid
Characteristics of Secretory Diarrhea

- Large volume, watery diarrhea
- **Little response to fasting**
- Stool composition is similar to plasma (high NaCl)
- Dehydration and plasma electrolyte imbalance are common
- No WBC or RBC in stool
Causes of Secretory Diarrhea

• **Medications**: Non-osmotic laxatives, antibiotics, many others

• **Infection (bacterial toxins)**: Cholera, E. Coli, Shigella, etc.

• **Endocrine**: carcinoid, gastrinoma, medullary thyroid cancer, VIPoma, hyperthyroidism

• **Bile salt malabsorption**: ileal resection, idiopathic

• **Small intestinal bacterial overgrowth**
Mechanisms of Diarrhea

- Osmotic diarrhea
- Secretory Diarrhea
- **Inflammatory**
- Malabsorption
- Altered bowel motility
- Miscellaneous
Pathophysiology of Inflammatory Diarrhea

Results from the outpouring of blood protein, or mucus from an inflamed or ulcerated mucosa.
Characteristics of Inflammatory Diarrhea

- Fever and systemic signs of inflammation (if severe/invasive organism)
- Small to moderate volume of diarrhea
- **Bloody diarrhea and/or WBC/RBC in stool**
  - Except in microscopic colitis
- Often accompanied by rapid motility/abdominal cramps
- Urgency/tenesmus if rectum is involved
Causes of Inflammatory Diarrhea

• **Inflammatory bowel disease**: ulcerative colitis, Crohn’s disease

• **Radiation colitis/enteritis**

• **Invasive or inflammatory infections**: *Clostridium difficile*, cytomegalovirus, *Entamoeba histolytica*, tuberculosis

• **Ischemia**
Clostridium Difficile Infection
Microscopic Colitis

- Chronic watery diarrhea
- Normal looking mucosa on colonoscopy
- Well established histological criteria
Mechanisms of Diarrhea

- Osmotic diarrhea
- Secretory Diarrhea
- Inflammatory
- Malabsorption
- Altered bowel motility
- Miscellaneous
Characteristics of Malabsorptive Diarrhea
Causes of Malabsorption Diarrhea

- **Impaired nutrient hydrolysis**: pancreatic insufficiency
- **Impaired Micelle formation**: small bowel resection or regional enteritis, biliary obstruction, bacterial overgrowth
- **Damaged absorbing surface**: celiac sprue, tropical sprue, giardiasis, Whipple’s disease
- **Decreased absorptive surface area**: short bowel syndrome
- **Lymphatic obstruction**
Liver upregulates bile acid synthesis but cannot keep up with loss rate. Bile acid pool is reduced. Fat is malabsorbed.

Resection of > 100 cm of the terminal ileum.

100 cm resection of terminal ileum
Mechanisms of Diarrhea

- Osmotic diarrhea
- Secretory Diarrhea
- Inflammatory
- Malabsorption
- Altered bowel motility
- Miscellaneous
Pathophysiology of Altered Bowel Motility

• Enhanced Motility (Intestinal Hurry) - decrease contact time of the stool to the absorptive surface

• Abnormally slow motility may result in bacterial overgrowth and resultant diarrhea
Characteristics of Altered Motility Diarrhea

- Moderate diarrhea - usually watery
- Often occurs after meals - accentuated gastro-colic reflex
- No WBC, RBC in stool
- Recently eaten food visible in stools
- Louder bowel sounds often apparent
- No diagnostic tests - often must rule-out secretory/osmotic/inflammatory causes
Causes of Altered Motility

- **Postsurgical**: vagotomy, partial gastrectomy

- **Systemic disorders**: scleroderma, diabetes mellitus, hyperthyroidism
It is not always one mechanism!!

- Increased secretion and motility
- Hypo-motility and bacterial overgrowth
- Pancreatic insufficiency
- Concurrent celiac
Mechanisms of Diarrhea

• Osmotic diarrhea
• Secretory Diarrhea
• Inflammatory
• Malabsorption
• Altered bowel motility
• Miscellaneous
Irritable Bowel Syndrome
Factitious Diarrhea
Pseudodiarrhea

Stool incontinence  Over flow diarrhea
How you get Diarrhea- Made simple!

Irritation
- Drugs
  - PPI
  - Antibiotics
  - Vitamins and minerals

Infection
- Acute
  - Campylobacter
  - Giardia
  - C difficile
  - Norovirus
- Chronic
  - Parasites

Inflammation
- Acute
- Chronic
How you get Diarrhea- Made simple!

**Traveler’s Diarrhea**
- Bacterial
- Protozoal

**Epidemics and outbreaks**
- Bacterial
- Viral
- Protozoal

**Diarrhea in Diabetes**
- Motility
- Pancreatic insufficiency
- Bacterial overgrowth
- Celiac disease
- Drug side effects

**Hospital Diarrhea**
- C Difficile
- Tube feeding
- Fecal impaction
- Ischemic colitis
Seasonality

- **Winter**
  - Cholera
  - Rota virus

- **Spring**
  - Campylobacter
  - Salmonella
  - Shigella

- **Summer**
  - Campylobacter
  - Salmonella
  - Shigella

- **Fall**
  - Salmonella
  - E Coli
Frequency of bacterial or Protozoal pathogens

- Campylobacter: 42%
- Salmonella: 32%
- Shigella: 19%
- E Coli O157:H7: 7%

Frequency of pathogen in stool cultures
# Common Infectious Diarrhea

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Vector</th>
<th>Incubation period</th>
<th>Signs and Symptoms</th>
<th>Complications</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter</td>
<td>Chicken consumption</td>
<td>1-7 days</td>
<td>Abrupt abdominal pain and diarrhea</td>
<td>Cholecystitis</td>
<td>Quinolones</td>
</tr>
<tr>
<td></td>
<td>Raw milk</td>
<td></td>
<td>Can mimic appendicitis</td>
<td>Reactive arthritis</td>
<td>Azithromycin</td>
</tr>
<tr>
<td></td>
<td>Travel</td>
<td></td>
<td></td>
<td>GB syndrome</td>
<td>3-7 days</td>
</tr>
<tr>
<td></td>
<td>Sick animal</td>
<td></td>
<td></td>
<td></td>
<td>Consider Quinolone Resistance in poultry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>and travel related cases</td>
</tr>
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<tr>
<td>Salmonella</td>
<td>Chicken Eggs</td>
<td>1-3 days</td>
<td>Nausea vomiting and diarrhea “Pea soup diarrhea”</td>
<td>Only if severe symptoms, fever or hospitalized Or if immunocompromised</td>
<td>Quinolones</td>
</tr>
<tr>
<td></td>
<td>Eggs Fresh produce Meat Pets and pet foods</td>
<td></td>
<td></td>
<td></td>
<td></td>
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## Common Infectious Diarrhea

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<th>Treatment</th>
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</thead>
<tbody>
<tr>
<td>Shigella</td>
<td>Cold salad Day care centers MSM</td>
<td>1-7 days</td>
<td>Fever Abdominal pain Bloody or Mucoid diarrhea</td>
<td>Intestinal perforation Reactive arthritis Hemolytic uremic syndrome</td>
<td>Antibiotic for public health reason in culture positive infection Quinolones for 5 days</td>
</tr>
</tbody>
</table>
## Common Infectious Diarrhea

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<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>E Coli Enterohemorrhagic E Coli O157:H7</td>
<td>Beef Spinach</td>
<td></td>
<td>Bloody diarrhea</td>
<td>HUS</td>
<td>NO antibiotics Increase risk of HUS</td>
</tr>
</tbody>
</table>
Evaluation of Diarrhea

Initial Evaluation
- Dehydration
- Duration
- Inflammation

Initial Treatment
- Hydration
- Diet modification

Assessment of severity
- Hypovolemia
- Bloody stools
- Fever
- > 6 stools/day
- > 1 week
- Elderly patient
- Immunocompromised
Evaluation of Diarrhea

Severe Diarrhea/ persistent Diarrhea

Stool leukocytes/Lactoferrin
Stool cultures routine / non routine cultures if risk factors
C Difficile test if antibiotics or risk factor

Inflammatory Diarrhea
Campylobacter/Shigella/C difficile
Consider empiric therapy while waiting for cultures

Non inflammatory diarrhea
Viral /Giardia /drugs
## Clues in history

<table>
<thead>
<tr>
<th>Food</th>
<th>Pathogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poultry</td>
<td>Campylobacter</td>
</tr>
<tr>
<td>Eggs</td>
<td>Salmonella</td>
</tr>
<tr>
<td>Hamburger</td>
<td>E Coli</td>
</tr>
<tr>
<td>Vegetables / cold salad</td>
<td>Shigella</td>
</tr>
<tr>
<td>Cole slaw and potato salad</td>
<td>Listeria</td>
</tr>
</tbody>
</table>
Visual Clues to Different Diseases
Diarrhea with Rash - Guess what disease is this?
Diarrhea with a Big Tongue
Diarrhea with Tremors
Evaluation of Diarrhea

• Fecal leukocytes and Fecal Lactoferrin
  • 73 % sensitivity
  • 84 % specificity
  • Lactoferrin more precise

• Stool cultures
  • Routine cultures include campylobacter, salmonella and shigella

• Ova and Parasite
  • Routine testing not cost effective
When to obtain ova and parasite

- Persistent Diarrhea (Giardia, cryptosporidium etc)
- Travelling from other countries
- Infants in daycare centers
- Men who have sex with men (MSM)
- Community water borne outbreak
- Bloody diarrhea and stool leukocytes negative (intestinal amebiasis)

Rehydrate the Dehydrate

• Signs of Dehydration
  ➢ Dry mouth and tongue
  ➢ Increased thirst
  ➢ Skin goes back slowly when pinched
  ➢ Decreased urine
  ➢ Lethargy
  ➢ Weak pulse
  ➢ Low blood pressure

• A rough estimate of oral rehydration rate for adults is 100 ml ORS every 5 minutes

• Severe dehydration requires intravenous fluids- Ringer’s lactate or normal saline
Oral Rehydration

• Underutilized
• Sodium-glucose co transport remains intact in diarrheal diseases
• WHO-ORS formula
• Home made recipe
  • ½ teaspoon of salt
  • ½ teaspoon of baking soda
  • 4 tablespoons of sugar
  • 1 liter of water

Oral Rehydration

• Diluted fruit juices
• Flavored soft drinks along with saltine crackers
• Fluids used for sweat replacement (e.g., Gatorade) are not equivalent to oral rehydration solutions
## Oral Rehydration Solutions

<table>
<thead>
<tr>
<th>Solution</th>
<th>Osmolarity m OSM/kg</th>
<th>Carbohydrates g/L</th>
<th>Na mEq/L</th>
<th>K mEq/L</th>
<th>HCO3 mEq/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO 2002</td>
<td>245</td>
<td>13.5</td>
<td>75</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>PediaLyte</td>
<td>250</td>
<td>25</td>
<td>45</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>CeraLyte</td>
<td>235</td>
<td>40</td>
<td>70</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Apple Juice</td>
<td>700</td>
<td>100</td>
<td>3</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Gatorade</td>
<td>330</td>
<td>45</td>
<td>20</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Ginger Ale</td>
<td>565</td>
<td>90</td>
<td>3.5</td>
<td>0.1</td>
<td>3.6</td>
</tr>
<tr>
<td>Tea</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Dietary Recommendations

High fat diet
Lactose

Boiled starches and cereals
Crackers, bananas, soup, and boiled vegetables
Probiotics
Empiric Antibiotic Therapy

• **Avoid** antibiotics when suspecting enterohemorrhagic E Coli
• Increased risk of hemolytic uremic syndrome from release of Shiga toxin
• Suspect EHEC in patients with bloody diarrhea and abdominal pain and no fever
• **Assess for C difficile risk** before giving antibiotics
• Empiric therapy for three to five days in the absence of suspected EHEC or fluoroquinolones-resistant campylobacter infection
• Quinolones such as Ciprofloxacin 500mg PO BID for 3-5 days
• Azithromycin 500 mg once a day for 3-5 days if Quinolone resistance suspected such as poultry induced campylobacter
Probiotics

- A 2010 meta-analysis- 63 randomized controlled trials
- Probiotics reduce the overall risk of diarrhea lasting four or more days by 59 %
- Reduce mean duration of diarrhea by 25 hours
- The two most commonly studied Probiotics
  - Lactobacillus GG and S. boulardii
- No adverse events noted
Zinc Supplement

- Zinc supplement has been shown to reduce the duration and severity of diarrhea
- 10-20mg zinc supplement can be considered

BMJ. 2008;336(7638):266-71
How Diarrhea is Spread – F Diagram
A few words by Traveler's diarrhea- Turista!
A few words by Traveler's diarrhea- Turista!

- Most common illness among travelers
- 10 million persons annually suffer from TD
- High-risk destinations are the developing countries of Latin America, Africa, the Middle East, and Asia
- Diarrhea that develops during or within 10 days of returning from travel
A few words by Traveler's diarrhea - Turista!

- Malaise, anorexia, and abdominal cramps followed by the sudden onset of watery diarrhea
- Enterotoxigenic *Escherichia coli* (ETEC)
- Belching and bloating may point towards Giardia or Protozoal infection
- Differential diagnosis - food poisoning such as shellfish poisoning
- Post infectious IBS – potential complication
A few words by Traveler's diarrhea- Turista!

• High-risk
  • Young adults
  • Immunosuppressed persons
  • Persons with inflammatory-bowel disease
  • Diabetes
  • Persons taking H-2 blockers or antacids
A few words by Traveler's diarrhea- Turista!

• Effective Preventive Measures

- Avoid eating foods or drinking beverages purchased from street vendors
- Avoid eating raw or undercooked meat and seafood
- Avoid eating raw fruits (e.g., oranges, bananas, avocados) and vegetables unless the traveller peels them
A few words by Traveler's diarrhea- Turista!

• CDC does not recommend antimicrobial drugs to prevent TD
• Bismuth subsalicylate can be used if needed
  o Antibacterial and anti secretory action
  o Blackening of tongue
  o Ringing in ear
Summary

• Diarrhea can be associated with serious morbidity and mortality
• Not all diarrheas are same
• Not all diarrheas are treated same
• Some require antibiotics but majority of acute diarrhea are self limited
• Supportive care and hydration is important
• Prevention is better than cure!