

REVIEW ARTICLE

PATHOLOGY

GASTROENTERITIS-OVERVIEW

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ABSTRACT

Gastroenteritis (also known as gastric flu, stomach flu, gastro and stomach virus, although unrelated to influenza) is marked by inflammation of the gastrointestinal tract involving both the stomach and small intestine resulting in diarrhea, vomiting and abdominal cramps.

The majority of cases in children globally are caused by rotavirus, while in adults norovirus is more common, at least in the United States. Less common causes include bacteria or their toxins, and parasites. Transmission may occur due to improperly prepared foods, contaminated water or close contact with those who are infectious.

The foundation of management is adequate hydration. For mild or moderate cases this can typically be achieved via oral rehydration solution. For more severe cases intravenous fluids may be needed. Gastroenteritis primarily affects children and those in the developing world.

KEY WORDS

gastroenteritis, common disease, overview

Epidemiology

Globally it is estimated that three to five billion cases of gastroenteritis occur yearly^[1] primarily affecting children and those in the developing world.^[2] It results in about 1.8 million deaths in children a year with most of these in the world's poorest nations.^[3] About half a million of those are due to rotavirus in those under 5 years of age.^[4] In the developing world children less than two years of age frequently get six or more infections a year.^[3] It is less common in adults partly due to the development of immunity.^[5]

In 1980 gastroenteritis from all causes caused 4.6 million deaths in children with most of these occurring in the developing world.^[6] Current death rates have come down significantly to approximately 1.5 million deaths annually in the year 2000, largely due to the global introduction of oral rehydration therapy.^[7]

In the United States it is the second most common infection after the common cold causing 200-375 million cases (~0.7 per person) of acute diarrhea yearly^{[5][3]} and resulting in ten thousand deaths.^[3]

History

The first usage of "gastroenteritis" is from 1825.^[8] Before this time it was *more specifically* known as typhoid fever or "cholera morbus", among others, or *less specifically* as "griping of the guts", "surfeit", "flux", "colic", "bowel complaint", or any one of a number of other archaic names for acute diarrhea.

Society and culture

Gastroenteritis is associated with many colloquial names including: "Montezuma's revenge", "Delhi belly", "la turista", and "back door sprint" among others.^[3] It has played a role in many military campaigns and is believed to be the origin of the term "no guts and glory".^[3]

Symptoms and signs

Gastroenteritis typically involves diarrhea, vomiting, and abdominal cramps.^[5] These symptoms usually begin 12–72 hours after contracting the infectious agent^[2] and if due to viral agent usually lasts less than one week.^[5] Some viral causes may also be associated with fever, fatigue, headaches, and muscle pains.^[5] If the stool is bloody the cause is less likely to be viral^[5] and more likely to be bacterial.^[9] Some bacterial infections may be associated with severe abdominal pain and may last for weeks without treatment.^[9]

Complications

Children infected with rotavirus usually make a full recovery after a few days.^[10] Dehydration is a common complication of diarrhea^[11] and a child with mild or moderate dehydration may have a prolonged capillary refill, poor skin turgor and abnormal breathing.^[12] In areas with poor sanitation repeat infections may lead to malnutrition^[2] stunted growth and delayed development.^[3]

Reactive arthritis occurs in 1% of people follow campylobacter infection and Guillian Barre syndrome (**GBS**) occurs in 0.1%.^[9] Hemolytic uremic syndrome may occur secondary to infections with Shiga toxin producing E. Coli or Shigella resulting in low platelets, poor kidney function, and low red blood cells due to their breakdown.^[13] Children are more predisposed to getting HUS.^[3]

Cause

Viruses particularly rotavirus, and the bacteria *E. coli*, and *Campylobacter* are the primary causes of gastroenteritis.^{[14][2]} There are however many other infectious agents that can cause this syndrome.^[3]

Viral

The viruses that cause gastroenteritis include rotavirus, norovirus, adenovirus and astrovirus.^{[5][15]} Rotavirus is the most common cause of gastroenteritis in children both in the developed and developing world^[14] and viruses cause about 70% of episodes of infectious diarrhea in this age group.^[16] Rotavirus is a less common cause in adults due to acquired immunity.^[17]

Norovirus is a leading cause of gastroenteritis among United States adults being behind greater than 90% of outbreaks.^[5] These outbreaks typically occur when groups of people spend time in close proximity such as on cruise ships.^[5] People may remain infectious even after the diarrhea has ended.^[5]

Bacterial

In the developed world *Campylobacter jejuni* is the primary cause of bacterial gastroenteritis with half of these cases associated with poultry.^[9] In children bacteria are the cause of about 15% of cases.^[16] The most common types are: *Salmonella*, *Shigella*, *Escherichia coli*, and *Campylobacter*.^[16] If food becomes contaminated with bacteria and remains at room temperatures for a period of hours, the bacteria can multiply and increase the risk of infection in those who eat the food.^[7]

Toxicogenic *Clostridium difficile* is an important cause of diarrhea that occurs more often in the elderly.^[3] Infants can carry these bacteria without developing symptoms.^[3] Traveler's diarrhea is usually a type of bacterial gastroenteritis.

Acid suppressing medication appears to increase the risk of infections by a number of organisms including *Clostridium difficile*, *Salmonella*, and *Campylobacter*.^[18] The risk is greater with proton pump inhibitors than with H2 antagonists.^[18]

Protozoal

A number of protozoa can cause gastroenteritis, most commonly *Giardia lamblia* but also cryptosporidium and *Entamoeba histolytica*.^[16]

These as a group make up about 10% of cases in children.^[13]

Transmission

Transmission may occur among via contaminated water or people sharing personal objects.^[2] In places with a wet and dry seasons water quality typically worsen during the wet season and this is usually the time of outbreaks.^[2] In areas of the world with seasons infections are more common in the winter.^[3] Bottle-feeding using improperly sanitized bottles is a significant cause globally.^[2] Transmission may also be related to poor hygiene especially among children^[5] and is increased in those with a poor preexisting nutritional status.^[3] Adults after developing tolerance may carry certain organisms without symptoms and thus act as natural reservoirs.^[3] While some agents only occur in primates such as *Shigella* others may occur in a wide variety of animals such as *Giardia*.^[3]

Pathophysiology

Gastroenteritis is defined as vomiting or diarrhea due to either an infection of the small or large bowel.^[3] The changes in the small bowel are typically noninflammatory while the ones in the large bowel are inflammatory.^[3] The number of pathogens required to cause an infection is variable from as few as one for *cryptosporidium* to as many as 10^8 for *cholera*.^[3]

Diagnosis

Gastroenteritis is typically diagnosed based on a person's symptoms.^[5] Determining the exact cause is usually not needed as it does not alter management.^[2] As hypoglycemia may occur in ~10% of children measuring serum glucose is recommended.^[12] Diagnostic testing may be done for surveillance.^[5] Electrolytes and kidney function should also be checked when there is a concern for severe dehydration.^[16] Stool cultures should be performed in those with blood in the stool, who might have been exposed to food poisoning, and those who have recently traveled to the developing world.^[16]

Differential

Other potential causes of these symptoms may need considering such as: appendicitis, volvulus, inflammatory bowel disease, urinary tract infections, and diabetes mellitus.^[16] Also, pancreatic insufficiency, short bowel syndrome, Whipple's disease, coeliac disease, and laxative abuse should be excluded as possibilities.^[29]

Management

Gastroenteritis is usually an acute and self-limited disease that does not require medication.^[20] The preferred treatment in those with mild to moderate dehydration is oral rehydration therapy (ORT).^[13] Metoclopramide and ondansetron however may be helpful in some children,^[21] and butylscopolamine is useful in treating abdominal pain.^[22]

Rehydration

The primary treatment of gastroenteritis in both children and adults is rehydration. This is preferably achieved by oral rehydration therapy although intravenous delivery may be required if there is a decreased level of consciousness or dehydration is severe.^{[23][24]} Complex-carbohydrate-based ORT such as those made from wheat or rice may be superior to simple sugar-based ORT.^[25] Sugary drinks such as soft drinks and fruit juice are not recommended in children under 5 years of age as they may increase diarrhea.^[20] Plain water may be used if specific ORT are unavailable or not palatable.^[20] A nasogastric tube can be used in young children to administer fluids.^[16]

Dietary

It is recommended that breastfed infants continue to be nursed per usual and that formula-fed infants continue their formula immediately after rehydration with ORT.^[26] Lactose-free or lactose-reduced formulas usually are not necessary.^[26] Children should continue their usual diet during episodes of diarrhea with the exception that foods high in simple sugars should be avoided.^[26] The BRAT diet (bananas, rice, applesauce, toast and tea)

is no longer recommended, as it contains insufficient nutrients and has no benefit over normal feeding.^[27] Some probiotics have been shown to be beneficial in reducing both the duration of illness and the frequency of stools.^[28] Fermented milk products (such as yogurt) may also be beneficial.^[29] Zinc supplementation appear to be effective in both treating and preventing diarrhea among children in the developing world.^[30]

Antiemetics

Antiemetic medications may be helpful for treating vomiting in children. Ondansetron has some utility with a single dose associated with less need for intravenous fluids, fewer hospitalizations, and decreased vomiting.^{[31][32][33]} Metoclopramide might also be helpful.^[34] However there was an increased number of children who returned and were subsequently admitted in those treated with ondansetron.^[34] The intravenous preparation of ondansetron may be given orally.^[35]

Antibiotics

Antibiotics are not usually used for gastroenteritis, although they are sometimes recommended if symptoms are severe^[36] or a susceptible bacterial cause is isolated or suspected.^[37] If antibiotics are decided on, a macrolide such as azithromycin is preferred over a fluoroquinolones due to the higher rates of resistance to the latter.^[9] Pseudomembranous colitis, usually caused by antibiotics use, is managed by discontinuing the causative agent and treating with either metronidazole or vancomycin.^[6]

Antimotility agents

Antimotility medication has a theoretical risk of causing complications; clinical experience, however, has shown this to be unlikely.^[19] They are thus discouraged in people with bloody diarrhea or diarrhea complicated by a fever.^[38] Loperamide, an opioid analogue, is commonly used for the symptomatic treatment of diarrhea.^[39] Loperamide is not recommended in

children as it may cross the immature blood brain barrier and cause toxicity. Bismuth subsalicylate, an insoluble complex of trivalent bismuth and salicylate, can be used in mild to moderate cases.^[19]

Prevention

Percentage of rotavirus tests with positive results, by surveillance week, United States, July 2000—June 2009.

Lifestyle

A supply of easily accessible, uncontaminated water and good sanitation is important for reducing rates of infection.^[3] Personal measures such as hand washing have been found to decrease the rates of gastroenteritis in both the developing and developed world by about

30%.^[12] Alcohol based gels may also be effective.^[12] Breastfeeding is important especially in places with poor hygiene as is improvement of hygiene generally.^[2] Avoiding contaminated food or drink may also be effective.^[40]

Vaccination

It is recommended that the rotavirus vaccine be offered to all children globally due to both its effectiveness and safety.^[14] Since 2000, the implementation of a program in the United States has substantially decreased the number of cases of diarrhea.^{[41][42]} The first dose should be given to infants between the ages 6 and 15 weeks.^[14]¹⁴ The oral cholera vaccine has been found to be 50–60% effective over 2 years.^[43]

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