

# Infectious Gastroenteritis: Causes, Diagnosis, Treatment and Prevention

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## Summary

Gastroenteritis is an infectious disease of high morbidity and mortality thus of serious public health significance. The burden of this infection is quite critical in the developing countries due to lack of potable water, malnutrition and poor sanitation. Etiology of infectious gastroenteritis consists bacteria which include *Escherichia coli*, *Salmonella* species, *Shigella* species, *Aeromonas* species, *Staphylococcus aureus*, *Campylobacter* species and *Yersinia enterocolitica* while the viral etiologies include Rotavirus, Norovirus, Adenovirus, Coronavirus, Calicivirus, Astrovirus and Enteroviruses. The clinical symptoms include vomiting, diarrhea, flatulence, abdominal pain indigestion, cramps, indigestion, belching and gagging. Laboratory diagnosis of bacteria involved in gastroenteritis involves routine stool culture on selective and differential media, culture of rectal swabs especially for *Shigella* and *Salmonella* while noncultural methods. Anaerobic culture is carried out to isolate *C. difficile* in addition to three special techniques which include glutamate dehydrogenase (GDH) enzyme immunoassays (EIAs), toxin A/B enzyme immunoassays and toxin A/B gene nucleic acid amplification tests (NAATs). Syndromic panels have been successfully used to diagnose viral gastroenteritis. Antibiotic susceptibility testing is important for treatment of bacterial gastroenteritis while viral gastroenteritis should be carefully managed. Infectious gastroenteritis is self-limiting in some instances but can be treated with several antibiotics some of which include penicillin cephalosporins, penem, nitroimidazole, glycopeptides, sulfa combinations, antifolate and monolactam antibiotics. Improved personal hygiene and consumption well cooked foods and avoiding expired canned foods among other healthy food handling methods will minimize the incidence of infectious gastroenteritis.

**Keywords:** Gastroenteritis; Diarrhea; Vomiting; Shiga-toxin producing *Escherichia coli*; Syndromic panels

## Introduction

Gastroenteritis is the inflammation of the stomach and intestine, typically resulting from bacteria bacterial toxins or viral infection and causing nausea, cramps, vomiting and diarrhea. There are two primary mechanisms responsible for acute gastroenteritis which are:

- a) Damage to the villous brush border of the intestine, which result in malabsorption of the intestinal contents leading to an osmotic diarrhea and
- b) The release of toxins that bind to specific enterocyte receptors thereby causing the release of chloride ions.

The primary mechanism for bacterial gastroenteritis is:

- a) Excessive secretion of fluids in the proximal small intestine induced by the action of the luminal toxin expressed by entero-pathogens or minimally invasive bacteria

- b) Inflammatory or cytotoxic damage of the ileal or colonic mucosa which may produce blood or pus
- c) Penetration of the bacterium through the mucosa into the reticuloendothelial system, as is the case of typhoid fever [1].

Over 1.7 billion global causes of diarrheal disease are reported annually which result in an estimated 2.2 million deaths. The burden of diarrhea disease is quite critical in developing countries as a result of unsafe water supplies, nutritional deficiencies and very poor sanitation [2]. Diarrhea disease in children aged less than five years in those countries is quite devastating, where repeated diarrheal episodes contribute greatly to malnutrition thereby resulting at heightened risk of acquiring infectious diarrhea among those children, thus leading to stunted growth and impaired cognitive development [3]. In the U.S.A. alone, an estimated 211 to 375 million episodes of diarrheal diseases occur annually with

18 million hospitalizations and 3,100 deaths [4]. Gastroenteritis is a very common condition that causes diarrhea and vomiting and most cases in children are caused by a virus called Rotavirus. Cases in adult are usually caused by Norovirus which is usually associated with vomiting during winter or bacterial food poisoning. Diarrhea is defined by infectious Diseases Society of America (NSA) and the American College of Gastroenteritis (ACG) as the passage of 3 or more loose or liquid stools per day. Duration of symptoms is also used to classify diarrhea for >14 days but ≤ 1 month are said to have persistent diarrhea, those experiencing diarrhea for longer than 30 days are said to have chronic diarrhea [5]. Diarrhea may be infectious i.e., caused by bacteria, viruses or parasites but with increasing frequency in high income countries, the etiology of diarrhea is non-infectious. In developed countries, diarrhea is caused by food, intolerance, reaction to medication intestinal disorders is like irritable bowel syndrome or intestinal disorders including Crohn's disease, ulcerative colitis and celiac disease. In the above instance, laboratory tests for infectious etiology, including a bacterial stool culture, are useful for reliable diagnosis for definitive diagnosis of both infectious and non-infectious gastroenteritis. Diagnosis clinical diagnosis of gastroenteritis is often based on several symptoms. People with gastroenteritis usually have pain in the abdomen, belching, diarrhea, flatulence, gagging, indigestion, nausea, stomach cramps or vomiting. The general whole-body symptoms include dehydration, fatigue, fever, chills, lethargy, light-headedness or loss of appetite. Other common symptoms include fast heart rate, headache, insufficient urine production, weakness and or weight loss [4,6].

## Causes

The most common causes of gastroenteritis are a viral or bacterial infection but less commonly of parasitic etiology. The most common causes of bacterial gastroenteritis are *Escherichia coli*, *Salmonella*, *Shigella*, *Yersinia enterocolitica*, *Aeromonas* species and *Campylobacter* while most virus causes are Norovirus, Adenovirus, Coronavirus, Astroviruses, Enteroviruses and Rotavirus [3]. Parasites implicated in gastroenteritis include *Cryptosporidium* which infection is contracted in contaminated swimming pool and accidentally swallowing water or surfaces if hands are not properly washed after going to the toilet. Giardiasis, a parasitic infection is caused by eating contaminated water, handling infected animals or changing the nappy of an infected baby without washing hands afterwards. Certain chemicals like lead can trigger gastroenteritis and certain medication such as antibiotics, can cause gastroenteritis in susceptible people. Although infectious gastroenteritis usually resolves in its own, i.e. it is self-limiting in some cases. However, it can lead to severe consequences mainly through dehydration. Worldwide, 1.45 million people die due to infectious gastroenteritis each year [3,5].

## Clinical Diagnosis

Bacterial gastroenteritis is a digestive problem caused by bacteria and its characteristics symptoms include nausea, vomiting, fever, diarrhea, belly cramping and pain. In severe cases, patients become dehydrated and this have electrolytes imbalance. Clinical

diagnosis is often based on medical history to ensure that nothing else is causing the symptoms. Doctors perform sigmoidoscopy or radiological examination to exclude the possibilities of inflammatory bowel disease (e.g. Chron's disease) and pelvic abscesses (pocket of pus) [7]. Viral gastroenteritis is contagious and spread through close contact with infected persons especially by sharing food, water or eating utensils or by touching surfaces contaminated by an infected person and then touching one's mouth. Viral gastroenteritis is familiar to most of us as 'stomach flu' and only the common cold occurs more frequently [8]. The pathogenesis of Rotavirus is as follows:

- a) Rotavirus attaches and enter the mature electrolytes at the tip of the small intestinal villi.
- b) Cause structural changes to the bowel mucosa, including villous shortening and mononuclear inflammatory infiltrates in the lamina propria.
- c) This virus induces maldigestion of carbohydrate and the intestinal lumen (in the absence of lactose).
- d) Malabsorption of nutrients and concomitant inhibition of water reabsorption can lead to the malabsorption component of diarrhea.
- e) Rotavirus secretes an enterotoxin, NSP4 which leads to a calcium dependent chloride secretory mechanism [3,4].

Depending on the cause, viral gastroenteritis symptoms may appear within one to three days after infection and ranges from mild to severe. Symptoms usually last just a day or two but occasionally persist for as long as 10 days. In young children, diarrhea and vomiting can cause an electrolytes imbalance, which is very dangerous and can lead to death if untreated. In viral gastroenteritis, other symptoms like fever, headache, body chills and fatigue are common, leading to much confusion that is often misdiagnosed as flu [4].

## Laboratory Diagnosis

Diagnosis of bacterial gastroenteritis is by the routine stool culture. Exceptions to this are the use of antigen and/ or nucleic acid amplification tests for the detection of

- a) *C. difficile* and to a lesser extent
- b) Shiga toxin-producing *Escherichia coli* (STEC) and
- c) *Campylobacter*

Feces should be collected in the acute phase of a diarrhea disease in the specimen of choice when bacteria gastroenteritis is suspected. If liquid or soft approx. 5 ml should be collected and if formed, 0.5 to 2g is adequate for culture. Feces should be collected in a clean dry container with a light lid and should not be contaminated with urine, barium, or toilet paper. Specimen container or collection devices should be labelled with patient's full name and two additional patient's identifiers such as medical record number and date of birth [9]. Rectal swabs are generally considered as less sensitive than stool for culture, but there are certain patient

populations for which a properly collected rectal swab may be acceptable. For instance, a rectal swab is a useful specimen to collect from infant and young children or when trying to recover *Shigella*. Rectal swabs must be inserted deep enough into the rectum approximately 1 in beyond the anal sphincter and carefully rotated, so that feces can be collected and visible on the swab. The swab should be placed in all-purpose-transport medium and sent to the laboratory. In addition to feces, blood, bone marrow and/or urine samples may be collected from patients presenting with symptoms consistent with typhoid fever. The antibiotic susceptibility of the bacterial isolates should be determined using the disk diffusion method by Bauer et al. [10]; CLSI, [11]. Recovery of *C. difficile* by anaerobic culture is possible but should not be used as a primary diagnostic test for *C. difficile* infection because of long turnaround times. There are three test method [s commonly used to detect the presence of toxigenic *C. difficile* in stool specimen and they include glutamate dehydrogenase (GDH) enzyme immunoassays (EIAs), toxin A/B enzyme immunoassays and toxin A/B gene nucleic acid amplification tests (NAATs). These non-culture detection methods used in the diagnosis of bacterial gastroenteritis [12]. The use of syndromic panels for diagnosis of infectious diseases have gained prominence for patients who present influenza-like illness for respiratory viruses. Five multiplex nucleic acid tests are already in use for detection of organisms associated with gastroenteritis. This method has been successfully employed in the diagnosis of gastroenteritis of viral and parasitic etiology [13,14].

## Treatment

Generally, bacterial gastroenteritis can be treated at home by getting plenty of rest, drinking enough fluid to stay hydrated, eating small amount of mineral rich food at regular intervals, avoiding dairy products food high in fiber and fruit. Bacterial gastroenteritis often clears up on its own without any treatment. However, vomiting and diarrhea can cause dehydration, so it is necessary to stay hydrated at home by drinking plenty of fluids especially water. Treatment is important for symptomatic cases, although some parasitic and bacterial infections require specific anti-infective therapy. Common antibiotics used to treat gastroenteritis include penicillin, cephalosporin, antifolate sulfa combinations, nitroimidazole, penem, glycopeptide and monolactam antibiotics [7]. Vomiting and diarrhea cause the individual to lose essential minerals such as sodium, potassium and calcium. Eating soups or broth can replace body fluids and minerals. Fluid and mineral replacement solutions are sold in pharmaceutical stores. Where a person cannot keep fluids down or become too dehydrated, the hospital should be visited so as to be given intravenous fluids and electrolytes. One's doctor should be contacted before taking any over the counter (OTC) medications to treat bacterial gastroenteritis, as some medications may prolong symptoms. Anti-vomiting drugs or anti-diarrheal drugs must avoid unless prescribed or recommended by one's doctor because they are likely to keep infection the body.

## Prevention

Infectious gastroenteritis can be prevented by several means, some of these methods are highlighted as follows:

- a) Personal hygiene practices generally prevent gastroenteritis.
- b) Thorough hand washing with soap before handling food and after using the toilet.
- c) Clean the toilet and bathroom regularly, especially the toilet seat, door handles and taps
- d) Washing hands thoroughly with soap after touching animals, particularly farm animals
- e) Avoiding close contact with people infected with gastroenteritis.
- f) Using a separate cutting board for raw meat.
- g) Avoiding eating of raw meat and fish.
- h) Keep all kitchen surfaces and equipment clean
- i) Store food appropriately and discard expired or spoiled product.
- j) Drinking only bottled water when travelling especially in developing countries [4,15].

## Conclusion

Infectious gastroenteritis is a disease which etiology include bacteria, fungi, viruses and parasites which is characterized by high morbidity and mortality, therefore a disease of public health significance. The disease is more of a health problem in developing than developed countries as a result of lack of potable water, nutritional deficiencies and poor personal hygiene in the former. Gastroenteritis is self-limiting but can as well be successfully treated with antimicrobial drugs. It can be effectively diagnosed and treated through stool and blood Cultures. A few non-culture methods are available identification of some fastidious causes of gastroenteritis. The disease affects children and adults, therefore attempts at preventing the disease is more rewarding so as to minimize the untoward consequence with its attendant financial burden.

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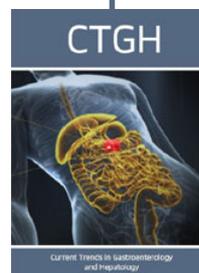
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