Review: Associated microorganisms to gastrointestinal infections

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ABSTRACT

Gastrointestinal infections are considered a public health problem, affecting around 1.700 million people each year, it is considered the second leading death cause in children under five years of age due to dehydration and is the fourth most common infectious disease globally, it generates a high socioeconomic impact due the costs generated, according to a bad preventive management in the developing countries as well as Inadequate therapeutic by not elucidate the causal agent nor virus, bacteria or parasitic microorganism Involved in the etiologic diagnosis. There have been studies of the prevalence of infectious causes of diarrhea infectious agents however, there are more regions in the world to be explored, which is possible base on the existence of molecular methods either for clinical diagnosis as well as for experimental work purposes in order to upgrade the epidemiological database. The objective of the review is to determine an overall situation of the global frequency and clinical presentation of the microorganisms involved in acute gastroenteritis.

RESUMEN

Las infecciones gastrointestinales se consideran un problema de salud pública, ya que afecta a alrededor de 1.700 millones de personas cada año, se considera la segunda causa de muerte en niños menores de cinco años de edad debido a deshidratación y es la cuarta enfermedad infecciosa más frecuente a nivel global, genera un alto impacto a nivel socioeconómico debido a los gastos que éstas generan debido al mal manejo preventivo en los países en vías de desarrollo así como por la inadecuada terapéutica al no elucidar el agente causal ya sea virus, bacteria o parasito el microorganismo involucrado en el diagnóstico etiológico. Se han realizado estudios de prevalencias de agentes infecciosos causales de diarrea, sin embargo, aún hace falta explorar más regiones, que en la actualidad es posible por la existencia de métodos moleculares tanto para diagnóstico como también para realizar trabajos experimentales con fines de actualización de bases de datos epidemiológicas. El objetivo de esta revisión es conocer una situación general de la situación a nivel mundial de la frecuencia y presentación clínica de los microorganismos involucrados en gastroenteritis aguda.

INTRODUCTION

The human gastrointestinal tract is home to a complex microbial community with more than 100 trillion members of prokaryotic cells, which were acquired sometime after the birth time, with different variations in the first year of life to become a stable community until the until it gets disturbed by the use of antimicrobial treatments and diseases. This microbiota plays an important role in the body's immune system, but there are other microorganisms that are capable of producing disease's, it is important to study this because the prevalence worldwide is very high and the fact that this creates morbidity and mortality risks, and also has a high social and economic impact for health institutions and the general population.[1]

MATERIAL AND METHODS

Electronic databases such as Science Direct, Annual Reviews, and Google Scholar were reviewed, using as filters texts quoted, review articles, original articles and textbooks, within these keywords as acute gastroenteritis, infectious diarrhea, stool samples were used, multiplex PCR Assays, feces culture, and once deployed information sources 29 articles that describe agents causing diarrhea in frequency according to the population, composition, clinical manifestation and through impact of history, both populations were selected east and west, and taking into account their inclusion methods individually and preferably had made diagnostic microorganisms by various methods, either immunological tests, microscopy, culture or PCR.

Microorganisms associated with gastrointestinal infections

Gastrointestinal infections are responsible for a high rate of morbidity in the world, although its highest incidence occurs in the developing countries, according to the World Health Organization (WHO) global health occur 1.700 million diarrheal diseases each year and kills 760,000 children under 5 each year for severe dehydration for this reason it is considered the second leading cause of death in the population at this age, even in developed countries, children under 3 years of age have on average 3 diarrhea episodes per year.[2] A broad spectrum of microorganisms may be responsible for the infection and present in common the same clinical manifestations being the most common symptoms diarrhea, vomiting, fever, abdominal pain, malaise, anorexia and dehydration at different levels of severity.[3] The medical diagnosis is usually relatively simple once a correct anamnesis and epidemiological history has been made, it is important to perform microbiological laboratory studies to determine the etiological agent responsible for the disease and initiate appropriate treatment.

Diarrhea is generally defined as three or more unformed stools evacuations per day and it is often associated with other enteric symptoms, diarrhea also may be considered to deposition of more than 250 grams of unformed stools per day. Based on the duration of diarrhea can be classified as chronic (greater than or equal to 30 days) acute diarrhea (less than 14 days), or persistent (14 to 29 days).[4]

The etiology of diarrhea, abdominal pain, and digestive disorders may be related to more than forty infectious pathogens which could be grouped in viruses, bacteria and parasites.[5]

Viral gastroenteritis is a common cause of morbidity and mortality in humans around the world and is considered the most common infectious gastroenteritis, the most common causative agents are Rotavirus *(RV)*, Norovirus (Nov), Sapovirus (SAV), Adenovirus (HAdV) and Astrovirus (HAstV).[6]

Some bacterial pathogens are able to develop persistent gastrointestinal symptoms and other complications; among the most frequently been identified: *E. coli*, *Campylobacter, Salmonella* and *Shigella*.[7] In identifying bacteria as a causal etiological agent of infectious gastroenteritis, the use of conventional bacterial culture is a relatively reliable method for systematic screening in detecting bacteria in stool samples although this usually takes several days to get a proper result.[3]

The degree of parasitic infections is usually under estimated, therefore the impact of concurrent infections in health by these etiologic agents is often overlooked because it is believed that this type of infection by one parasite causes a condition of low intensity and little or no morbidity, however, the evidence of an increment in of morbidity has increased in multiple parasitic infections and even these are considered low degree of intensity.[8,9]

In general, identification of enteropathogens in epidemiological studies has been greatly facilitated by testing polymerase chain reaction but they remain limited due to the requirements of the collection, storage and transport of stool samples.

Infectious diarrhea is worldwide, the fourth most common disease and thus represents a charge of 89.5 million years of life allotted to disability. Traveler's diarrhea is often experienced by the population of middle and low income and among the top three leading causes of infant morbidity and mortality in children under five years of age; it should be noted that in the United States 83% of deaths associated with diarrhea occur in people over 65 years old.[10]

The following are generally some of the specific pathogens most frequent cause of infectious gastroenteritis.

Norovirus

It is an RNA virus belonging to the family of *Calicivirus*, its genome is 7.5 kb comprised of three frames open reading ORF1 ORF2 and ORF3 encoding a poly nonstructural protein, high to low capsid proteins, respectively there are six genogroups (GI-G IV) of which the GI, G II and G IV infect humans, each genogroup is classified into genotypes. Norovirus infection is complicated in prevention and control due to the low dose of environmental stability needed infection, high titers, and shedding.[11] This virus can be spread from person to person primarily and intake of contaminated food or water. It is the most common cause of sporadic gastroenteritis and outbreaks of acute gastroenteritis at any stage of life which is dominated by genotype GII.4 since mid-1990, overall the *Norovirus* only in the United States each year is responsible for 19 to 21 million diarrheal diseases. The management of infection only requires fluid and electrolytes.[12]

Rotavirus

Since 1973 viral particles were identified in the duodenal mucosa of infants with diarrhea, the whole virus is a sphere of 68 nm in diameter and consists of two capsids surrounding a core of 38 nm which includes a double strand of genetic information, the capsule contains three

proteins inside (VP1, VP2, VP6), two or three on the outside (VP3, VP7, VP9), and four nonstructural proteins. Rotavirus attacks and infects the mature enterocytes of the villi. There are different groups of rotavirus and is the A group which mainly affects humans and the major discomfort that these causes are vomiting, low –grade fever and watery diarrhea that can last from 2 to 8 days, the condition is self– limiting so it only requires handling with hydration and good nutrition; after exposure to the virus infection can occur between day 5 and 6, and lasts between 6 and 10 days in the posterior intestinal tract infection.[13]

Shigella spp

It is a Gram-negative bacteria, facultative anaerobic belonging to the family *Enterobacteriaceae* that primarily infects the lower bowel resulting in bacillary dysentery. Genetic analysis show that is largely related to *E. coli* bacteria, it is considered a greater public problem in tropical areas related to gastroenteritis causing between 80 to 165 million cases of illness and 600,000 deaths annually.[14] It is classified into 4 subtypes and serotypes species each, but *Shigella flexneri* is the cause of 60% of *Shigella* infections globally, it is transmitted fecal-orally and only needs 10 to 100 microorganisms to cause diarrhea. *S. dysenteriae* is highly toxic and able to cause infection in any of its four species, Shiga toxin is causing of colitis and uremic syndrome, has a mortality rate of 20%.[15] Its clinical presentation corresponds to watery diarrhea that may be accompanied by mucus and blood, severe bacillary dysentery inflammatory, severe colic type abdominal pain and fever. Two-thirds of people who have died from this cause are children under 5 years old.[16]

E. coli O157: H7

It is a Gram-negative bacillus, the O is regarding their somatic antigen and the flagellar H antigen to specifically this type of *E. coli* it is complicated ferment sorbitol nor can produce the B-glucuronides and unlike others of its kind; this bacillus is known susceptible to treatment with ampicillin, sulfamethoxazole trimethoprim, fluoroquinolones and tetracycline's and erythromycin resistant, metronidazole and vancomycin, but recently also described resistance streptomycin, sulfisoxazole, and tetracycline's probably because this microorganism is in food animal origin which has been treated with antibiotics. In particular this *E. coli* O157: H7 belongs to diarrheogenic producing Shiga toxin because their genes are nearly identical to those of *Shigella dysenteriae* type 1.[17]

Salmonella

It is the causative agent of typhoid fever that is accompanied by systemic disease and gastroenteritis, those responsible are *S. typhi* and *paratyphi* as these affect humans, the most common symptoms are fever often greater than 39 ºC, cough, headache, abdominal pain, transient diarrhea or constipation, occasionally could cause maculopapular rashes, pink chest spots and increased pulse to 100 beats per minute. The entry of this pathogen in the body usually occurs by consuming contaminated water or food, there have been studies which indicate that the intake of 10,000 bodies of these are enough to cause disease. Enteric fever caused occurs due to the infiltration of mononuclear cells with consequent hypertrophy of the reticuloendothelial system, Peyer's patches and mesenteric lymph nodes the spleen and bone marrow.[18] The mortality without treatment is a 10 to 15% of patients. One reason for pathogenicity is encoding system 1 type III secretion (T3SS-1) which is a virulence factor enabling the pathogen to invade the intestinal epithelium, this pathogen is very similar to *E. coli* and known to a DNA region was acquired by horizontal gene transfer sometime.[19] As part of their treatment of choice it has shown susceptibility to fluoroquinolones, however, there are multi genotypes resistant associated with IncH1 or plasmids that a mutation occurred in *gyr A*, which encodes the subunit gyrase that is the main objective of fluoroquinolones, fortunately, is reversible once this has been removed for a time the use of fluoroquinolones.[20]

Campylobacter

They are small microorganisms as Gram-negative rods type and grow best in microaerobic conditions lead scourge in one of its poles which makes them actively motile with a corkscrew - like motion.[21] So far there has been 13 subspecies described but most are not pathogenic to humans, the most frequently reported *C. jejuni*, which requires an incubation period of 1 to 7 days, the dose required to present microorganism is 500 microorganisms disease, the degree of infection increases with higher doses but the degree of disease is not clearly dose related. The main symptoms are vomiting, abdominal pain, fever and diarrhea which may contain blood with mucus and fecal leukocytes, it is a common condition in developed countries.[22]

Vibrio cholerae

It is a Gram-negative bacteria which causes severe water rice like diarrhea which leads to a high risk dehydration

and death in about 48 hours if untreated. This organism is considered endemic worldwide and is estimated each year to occur between 3 to 5 million cases with 120,000 deaths, according to some studies it is estimated in the case of an outbreak, more than 5% of the population dies. *V. cholerae* serogroups contains more than 200 based on the O-antigen polysaccharide cell wall but only O1 and O139 cause outbreaks.[23] Among the antibiotics that have been tested for this organism, doxycycline is one which has shown high sensitivity in trimethoprim change sulfamethoxazole and furazolidone does not generate any effect, ciprofloxacin and ampicillin are considered in some studies as intermediate sensitivity.[24]

Entamoeba hystolitica

It is the main protozoan of the subphylum *Sarcodina*, is characterized by containing pseudopods as a basic element for mobility, their life cycle is mainly as trophozoite is the invasive form and the cyst which is responsible for the infective form, are anaerobes and its power source it is obtained by fermentation, and replicate by binary fission process.[25] In the world at least 500 million people that represent the 10% are infected, of which only 10% have symptoms and some 40.000 to 100.000 die each year because of this parasite. This disease is transmitted from asymptomatic carriers which makes it very important from an epidemiological point of view, so can be transmitted from patients with acute diarrhea, contaminated food or water, oral and anal sex. The incubation period ranges from days to years. Clinical manifestations as already mentioned may be asymptomatic, but in the intestinal amebiasis can be found chronic diarrhea invasive without special features, can also be accompanied by bleeding, dysentery and abdominal pain, weight loss, rectal tenesmus, high fever, although it is rare but especially in children could even cause intestinal perforation, amebiasis can also occur in extra-intestinal way liver abscess. As treatment should use two types of amebicides, luminal and tissue, for example diiodohidroxiquinoleina and metronidazole respectively.[26]

Giardia lamblia

It is a flagellate protozoan, anaerobic, it has 2 main phases, trophozoite and cyst. It contains two types of proteins on the membrane surface proteins variable and a heat shock protein which behave as immunodominant antigen. Epidemiologically it causes one of the most common parasitic disease in the world with a prevalence between 7-20% of the population in both developing and industrialized countries. The population considered vulnerable children 0-5 years, international travelers and people with weakened immune systems.[27] The fundamental forms of transmission is from person to person, through intake of contaminated food and water. Its incubation period ranges from 7 to 21 days but can range from 3 days to months. In 60% of cases, no symptoms are present, but frequent clinical manifestations are diarrhea aqueous sudden onset, flatulence, pattern change in type diarrhea yellowish, smelly, with little stools but abundant, abdominal distension, bowel sounds and frequent belching, is exceptional fever and blood in stool, chronic case may notice weight loss and stunted growth in children. As treatment is effective the use of tinidazole, metronidazole and paromomycin.[28]

DISCUSSION

Gastrointestinal diseases according to WHO data have a high prevalence worldwide, so that generate a problem not only in health, but also in economic and social, either because they probably are not handled properly hygienic guidelines or health and the guidelines of proper medical treatment due to poor study of etiological agents causing infectious gastroenteritis, as this has probably been underestimated because the diagnosis of these diseases is terminated according to the experience of caregiver health or accessibility of pharmaceuticals and self-medication which allows in many cases the vulnerability of the organism against pathogens that normally are unable to produce disease.

CONCLUSION

Once this issue has been reviewed we conclude that viruses are the main causes of diarrhea of infectious origin just above *E. coli* and *Shigella* according to the results of several studies, it has been studied that virus infections are self -limiting and that the basic treatment is rehydration, should not generate a strong economic impact on the population, not considering those cases that require hospitable admission. We also know that the mode of transmission for both viruses, bacteria and parasites it is given by the contact from person to person, fecal - oral ingestion of contaminated food and water or bad cooked food, it requires a great social effort and for the health sector to perform better preventive or control of such diseases. It is important for epidemiological purposes to the importance and knowing how often or prevalence a microorganism generates a health problem in each population individually, for this it requires us to be aware about

the importance of studying the etiologic agent causing infectious gastroenteritis either stool cultures, electronic or direct microscopy, immunoassay or PCR and generate databases in the towns where you do not already have this information.

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