PREVENTION OF GASTROINTESTINAL INFECTIOUS DISEASES IN ATHLETES

– Written by Agustin Jaime Alanis Flores and José Ángel Garza Cantú, Mexico

INTRODUCTION

Professional sports practice can expose athletes to an increased risk of infectious diseases due to multiple factors, including exercise-induced alterations in immune function, frequent travel, and environmental exposure (e.g., contaminated or muddy surfaces).

Although they may not appear to be a frequent threat, gastrointestinal illnesses are the second most common cause of illness in sports , and the extent of their impact on athletic performance can be substantial. Therefore, prevention is essential[1].

It is of utmost importance for sports physicians and support staff to understand the risks to which they are exposed and how to prevent the acquisition of gastrointestinal infectious diseases.

Table 1

More common	• ***Traveler's diarrhea*** • ***Food contamination*** • ***Viral gastroenteritis*** • ***Antibiotic -associated diarrhea*** • ***Parasitic infection***
Less common	• ***Irritable bowel syndrome*** • ***Ulcerative colitis*** • ***Lactose intolerance*** • ***Cancer*** • ***Intestinal obstruction*** • ***Intestinal ischemia*** • ***Competition stress and anxiety*** • ***Inaproppiate pre-excercise food choices***

Table 1: Causes of gastroenteritis and mimics.

KNOWING THE ENEMY

Infectious gastrointestinal diseases commonly cause gastroenteritis, defined as inflammation of the stomach, small intestine, and/or large intestine, which may result in a combination of symptoms including abdominal pain, cramping, nausea, vomiting, and diarrhea.

When symptoms last less than 14 days, the condition is considered acute; it is termed persistent when lasting 14 to 30 days, and chronic when lasting more than 30 days

ACUTE INFECTIOUS GASTROENTERITIS

Accurately determining the incidence of acute infectious gastroenteritis is challenging, as not all patients report symptoms or seek medical attention[2].

Most cases are caused by bacteria, with the majority attributed to Escherichia coli (enterotoxigenic)[2,3], followed by other pathogens such as Salmonella, Shigella, and Vibrio. Viruses account for a another

Table 2

Related to athlete	*Related to sport-pratice*	*Related to travel*
• *Young athletes* • *Female athletes* • *Aquatic athletes* • *Paralympic athletes* • *Immunosuppression due to training* • *Anxiety and depression* • *Poor food hygiene practices* • *Taking proton pump inhibitors*	• *Constant exchange of bottles for hydration* • *Meals during activity (halftime, breaks, etc)* • *Poor hygiene during training or matches* • *Sports food tends to be finger food* • *Contamination of the playing surfaces*	• *Buffet meals* • *Meals at the airport, plane, or on a bus* • *Food they are not used to* • *Trips longer than 5 hours*

Table 2: Risk of gastrointestinal infectious diseases in athletes.

part of the cases, with norovirus being the most common in adults and rotavirus in children[4].

One of the main effects is traveler's diarrhea. It is estimated that between 40% and 60% of people who travel to developing countries contract this condition, sometimes up to 10 days after returning home. Most cases are caused by bacteria, followed by viruses or parasites; nevertheless, coinfection may occur in up to 20% of cases.

Food contamination is another major threat, approximately one in five episodes of gastroenteritis can be caused by food contamination and can occur through three main mechanisms: preformed toxins, pathogens that produce toxins in the gastrointestinal tract after ingestion, and pathogens that invade the intestinal wall and cause inflammatory diarrhea. The most common contaminated foods are meat, eggs, salads, cereals, starchy foods such as rice, as well as beef, pork, vegetables, and home-canned goods.

However, undercooked food, contaminated water, unpasteurized milk, and cider can also cause problems. Although uncommon in athletes, antibiotic-associated diarrhea can occur in medical and support staff. If you have athletes or immunocompromised staff, you should be aware of this illness. Commonly associated antibiotics include fluoroquinolones, clindamycin, cephalosporins, penicillins, doxycycline, aminoglycosides, vancomycin, and metronidazole.

CHRONIC INFECTIOUS GASTROENTERITIS

The main causes of chronic infectious gastroenteritis are parasitic infections.

Immunocompromised individuals are more susceptible to chronic infectious gastroenteritis. Cryptosporidium and Giardia are the most common causative agents.

DIAGNOSTIC METHODS

Diagnosis is typically clinical and, based on symptomatology, may help guide the suspected etiologic agent[4-6]. Attention should be given to the onset of symptoms, severity (volume, frequency, and duration of diarrhea), and stool characteristics. It is also important to inquire about contact with sick individuals, recent hospitalizations, use of antibiotics or other medications, and sexual history[5]. Traditional diagnostic methods (bacterial culture, microscopy with or without immunofluorescence, and antigen testing) often fail to identify the etiology in most cases of acute diarrheal infection[7]. If you have a case in food handlers or support staff, or a case of dysentery, moderate to severe illness, or symptoms that last more than 7 days, we need to conduct a more in-depth diagnostic evaluation[5,7,8]. and don't forget to do a complete physical examination, and you should focus on hydration status, as well as signs such as fever, tachycardia, hypotension, peripheral pulses, capillary refill, and exclusion of an acute abdomen[4,5].

MEDICAL TREATMENT

Management of acute gastroenteritis or diarrhea should focus primarily on two objectives: maintaining adequate hydration and controlling symptoms. The use of antibiotics should be reserved for specific cases. The primary goal in acute gastroenteritis and/or traveler's diarrhea is to prevent dehydration through replacement of lost fluids, preferably via the oral route[1-3,5,6]. However, in cases of severe dehydration, alternative routes of fluid administration, such as intravenous administration, may be necessary.

Initial management may include a short period of clear liquids with adequate electrolyte replacement or low-osmolarity oral rehydration solutions[4].

An age-appropriate diet is recommended. Generally, foods such as cooked rice, potatoes, noodles, oatmeal with salt, soups, crackers, and bananas are good options.

Another good option could be the BRAT diet (bananas, rice, applesauce, toast) given that in general they are easily available. This reduces weight loss due to fluid loss and facilitates return to training. Another integral part of the management of gastrointestinal disease is the management of diarrhea. While antimotility agents such as loperamide or diphenoxylate may reduce stool frequency and duration of diarrhea[2,3,5,6]. Be careful with loperamide, because should not be used in cases of bloody diarrhea or dysentery due to the risk of toxic megacolon[6]. Another option could be bismuth subsalicylate, is useful in watery diarrhea and is considered safe in some cases of inflammatory diarrhea[5].

Another key part of the treatment is preventing the patient from vomiting or feeling nauseous; for this we can use antiemetics such as ondansetron or promethazine. Domperidone is an alternative option in some regions[3,4].

Antibiotics may shorten the duration of gastroenteritis; however, their use should be limited to specific situations such as moderate to severe traveler's diarrhea, signs of shock, inflammatory diarrhea, or immunocompromised patients[6]. The first

Table 3

	Traveler's Diarrhea	Foodborne Illnes				Viral gastroenteritis	
		Preformed toxins	Produces toxins after ingestion		Invade the wall intestinal and cause inflamatory diarrhea	Rotavirus	Norovirus
Etiology	Eschericihia coli (Enterotoxigenic), Salmonella, Campylobacter jeinuni and Shigella	Staphylococous aureus and bacillus cereus	Clostridium perfringens	Enterotoxigenic Escherichia coli (ETEC)	Enterohemorrhagic Escherichia coli (EHEC), which produces Shiga toxin	Rotavirus	Norovirus
Mode of transmission	Contaminated food or water	Contamination by food handlers	Ingestion of contaminated food	Food or beverages contaminated with fecal matter	Undercooked foods, contaminated water, unpasteurized milk and cider, daycare settings, and petting zoos	Primarily fecal-oral transmission, often through contaminated food or contact with infected individuals	Fomite contamination and aerosolization of viral particles, which are subsequently inhaled or ingested
Incubation period	4-14 davs after arrival at destination	1-6 hours	6-48 hours	24-72 hours	1-9 days (typically 3-4 days in tropical settings)	1-3 davs	10-51 hours
Signs and symptoms	Malaise, anorexia, abdominal pain cramping, diarrhea, nausea, vomiting, low grade of fever	Vomitin, nausea and / or diarrhea	Watery diarrhea and abdominal pain. Nausea, fever and vomiting are less common	Mild to severe diarrhea	Watery diarrhea that may progress to bloody diarrhea, leukocytosis, abdominal pain, cramping, and vomiting	Vomiting, nausea, and/or diarrhea; vomiting is more common in children, while diarrhea predominates in adults	Vomiting, nausea, and low-grade fever are most common Diarrhea and abdominal cramping may also occur
Duration	1-5 days tipically. More than 14 days a parasitic etiology should be suspected	Less than 24 hours	~24 hours	48-72 hpurs after ingestion	Mild cases: 7-10 days	6-8 days in children and 1-4 davs in adults	1-3 days
Diagnosis	Clinical, stool culture may be useful in inmunno-compromised patients	Based on clinical hystory	Based on clinical hystory, fekal leucoytes may be present	Based on clinical hystory	Stool culture for E. coli 0157:H7	Based on clinical history. May be confirmed with stool antigen testing or ELISA	Primarily clinical May be confirmed by stool testing (e.g., PCR-based assays; microscopy is not routinely used)
Treatment	Rehydration and symptomatic managment	Rehydration and symptomatic managment	Rehydration and symptomatic managment	Rehydration and symptomatic manasment	Rehydration and symptomatic manasment	Rehydration and symptomatic manasment	Rehydration and symptomatic manasment
Antibiotic therapy	Ciprofloxacin 500 mg as a single dose or every 12 hours for 1-2 davs. Rifaximin 200 mg every 8 hours	Not required	Not required	Ciprofloxacin 500 mg every 12 hours for 3 days. Trimethoprim-sulfamethoxazole 800/160 mg every 12 hours for 3 davs	Not required	Not required	Not required

Table 3: Types of acute infectious gastroenteritis and their characteristics.

line of agents for empiric treatment of traveler's diarrhea are the fluoroquinolones or macrolides[5].

TREATMENT CONSIDERATIONS IN ATHLETES

Although intravenous hydration may be considered in cases of severe dehydration, its use during competition may be considered doping. If necessary, a Therapeutic Use Exemption (TUE) must be obtained. Antibiotics and most symptomatic medications used to treat gastroenteritis are not typically associated with positive doping tests, when in doubt, the World Anti-Doping Agency (WADA) list should be consulted. Although antibiotics may be useful, fluoroquinolones are associated with an increased risk of tendinopathy and QT interval prolongation[2]. Another drugs like erythromycin are associated with QT interval prolongation and should be use with careful in athletes.

COMPLICATIONS OF GASTROENTERITIS

Acute infectious gastrointestinal diseases may lead to complications such as irritable bowel syndrome, reactive arthritis, or Guillain–Barré syndrome[3,5].

"WHEN WILL I BE BACK AND HOW ?" – RETURN TO PLAY

Return to train o return to compete may be considered when the athlete is afebrile, adequately rehydrated, able to tolerate solid foods, and free of residual gastrointestinal symptoms, or at least 48 hours have passed since the last episode of diarrhea or vomiting[2]. If you have the resources, safe return can be further supported by ensuring that hematocrit, electrolyte levels, and liver enzymes are within normal limits or trending toward normalization. We must not forget that training should be gradually resumed to allow recovery and prevent injury and we need to be realistic and know that athletes may not immediately return to peak performance upon resumption of activity.

PREVENTION

Prevention of gastrointestinal infections in athletes requires coordinated efforts, organization, commitment, and communication among all involved parties[9].

Educate to the athlethes its easy, achievable and accessible to all, the action

Figure 1: Encourage your athletes to wash their hands. Handwashing is a simple, easy, and accessible intervention that can help reduce the risk of spreading infectious diseases. It should be done with soap and water for at least 20 seconds, or with an alcohol-based hand sanitizer with an alcohol concentration of at least 60%.

of a proper hand hygiene is one of the simplest and most effective measures to prevent infectious diseases. Handwashing with soap and water for at least 20 seconds is recommended, or the use of alcohol-based hand sanitizers with concentrations above 60% and should be performed after using the restroom, changing diapers, preparing food, handling waste or laundry, or touching animals[2,5,7,8]. Try to teach to athletes on how to reduce risk is essential, specially when they eat out of the supervision of a team member. A simple recommendation is to follow the rule: "boil it, cook it, peel it, or forget it"[3,7,9], and remember to them that is advisable to avoid buffets, street food, dressings and sauces, sharing utensils, ice, and exposure to contaminated water sources[3,5]. Additional recommendations include consuming only thoroughly cooked and hot foods, peeled fruits, and bottled or canned beverages, preferably using a straw and avoiding unpasteurized dairy products and undercooked meat[2].

Another simple and useful tip is to remember to your athletes leave the cellphone in their pockets when they eat and clean the device frequently, because cellphones are usually contaminated.

Proper organization is an opportunity to prevent disease. Involving multidisciplinary teams in planning allows risk identification from multiple perspectives. Clear protocols should be established and communicated to all team members and staff.

Hygiene measures are essential, cleaning surfaces at least once daily—allowing disinfectant to remain for at least 1 minute and drying for 2–3 minutes—helps reduce risk. Hand sanitizing solutions should be readily available in kitchens, press rooms, training areas, restrooms, locker rooms, video rooms, and recreational areas.

We will make the effort to ensure that the kitchens where athletes' food is prepared and the establishments where food is consumed while traveling are certificated with international standards to ensure food safety such as ISO22000, FSCC22000 or at least meet with national regulations.

If you have a way to check it, all the people involved in the food preparation, should be checked at least 2 times por year against parasitic diseases and all areas where athletes are present, and especially the kitchen, must be continuously fumigated against insects.

The cross-contamination phenomenon are very common, not only in the cooking procedures, we must follow all the measures to avoid it during food purchasing and preparation.

When we are planning the menu for the athletes we should avoid serving finger food, or if you have no other option, serve them in individual cups or containers, or you can provide a spoon so they can serve themselves. Providing non-perishable foods during meals or snacks increases safety and reduces the risk of foodborne illness and ensuring that foods are thoroughly cooked and maintained at appropriate temperatures is essential ,and we should avoid the danger zone between 4–60°C[8]. Try to don't leave food that can spoil for more than 2 hours without refrigeration, or more than 1 hour if the temperature of the environment it's above 32°C, and if you heat food in the microwave, make sure it reaches a temperature above 72°C,to comply with these measures, it is very useful to have thermometers to measure the temperature of food or the ambient temperature or inside refrigerators. Technology can also help us prevent these diseases, you can use portable devices for detection of pathogens in the food ,these devices use technology like test strip detection and raman detection

Figure 2: Starting eleven against gastrointestinal infectious diseases.

for bacteria's, virus and parasites and give you the result in 15–45 minutes , allowing for immediate intervention.

To avoid forgetting any steps, you can create a checklist with all the things you need to do when handling, preparing, and assembling food. This simple action can help to significantly reduce the risk of infections.

All physicians should be familiar with the medical history of athletes and staff.

Monitoring symptoms through electronic or verbal surveys and recording them in athlete monitoring systems is recommended and can help us in the early detection of cases and, if we have an outbreak, provide information to study it.

In cases of illness, control measures such as strict hand hygiene and the use of gloves and gowns should be implemented to prevent transmission.

The sick athlete should also be advised to avoid swimming, aquatic activities, and sexual activity while symptomatic[8]. It is common for South American athletes to drink and share mate, but when they are sick they should be advised to avoid it due to the risk of contagion. Always make a plan for how to act in case of an outbreak. What will you do? When will you do it? How will you do it? Write it down and communicate it to the rest of the staff accompanying you. Always be prepared with enough medication to treat an outbreak, or plan where you will go to buy supplies if needed.

It is common to hear that the use of probiotics and prebiotics can help, but they are not routinely recommended[7].

The travel medicine will be a important factor in the development of sports medicine practice, the recent tendency to organize international tournaments in 2 or more countries present us a significant challenge to maintain the health in our athletes, a simple action like know your destiny, the risks and the epidemiology of infectious diseases will help you to prevent them .

Providing guidelines to athletes and traveling staff is good practice, along with distributing educational materials such as brochures or posters to raise awareness about risks and preventive measures. Try to give a kit for maintain the hygiene during the travel (portable hand sanitizer, antibacterial wet wipes, straws and disposable cutlery.

You should be involved in travel planning and prevent athletes from eating at airports and on buses. Although not explicitly stated in your duties as team physician, you can reduce the risk of illness impacting team performance by properly allocating accommodations and taking the precaution of not placing two players in the same position in the same room[9].

Antibiotic prophylaxis should be reserved for individuals with severe health conditions, high- performance athletes with limited time flexibility, or specific high-risk scenarios[2,3,7]. Rifaximin is a recommended option at 200 mg once daily or every 8 hours depending on the clinical context[3], another helpful drug is bismuth subsalicylate, provides moderate protection against diarrhea, reducing risk by approximately 65% when taken four times daily during travel[3,7].

As we know vaccination may reduce the risk of infectious diseases, cholera and typhoid vaccines are recommended for

individuals traveling to endemic areas or those with occupational risk[5,8], if you have the possibilities rotavirus vaccine may be administered to children without contraindications[8].

CONCLUSIONS

Preventing gastrointestinal infections is a task in which we all participate (doctors, physiotherapists, coaches, nutritionists, cooks, technical secretary, athletes, etc.).

And it is up to the team doctors to take the lead in identifying and counteracting the risks that may exist in our environment, among the athletes, and in situations such as travel. Planning and communication are key to achieving this. Thinking about the worst-case scenario and being prepared for it will allow us to make better decisions that will help maintain the athlete's health and our team's chances of success. And although unforeseen situations may arise that prevent us from succeeding, regardless of the outcome, we must do everything in our power to achieve our goal. Injuries and illnesses can be compared to loose a match—they are part of sport, but it is the responsibility of athletes, technical staff, and healthcare professionals to prevent them.

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Agustin Jaime Alanis Flores MD

Head of Medical Services for Youth Teams at Club de Fútbol Tigres UANL

José Ángel Garza Cantú MD

Head of departament of Sports Medicine and Physical Rehabilitation

Universidad Autonoma de Nuevo León

Nuevo León, Mexico

Contacts: dr.agustin.alanis@hotmail.com