### GI Pathogen Profile, multiplex PCR; stool

**Viruses**

<table>
<thead>
<tr>
<th>Virus</th>
<th>Within</th>
<th>Outside</th>
<th>Reference Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenovirus F40/41</td>
<td>Negative</td>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>Astrovirus</td>
<td>Negative</td>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>Norovirus GI/GII</td>
<td>Positive</td>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>Rotavirus A</td>
<td>Negative</td>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>Sapovirus (I, II, IV and V)</td>
<td>Negative</td>
<td></td>
<td>Negative</td>
</tr>
</tbody>
</table>

**Parasites**

<table>
<thead>
<tr>
<th>Parasite</th>
<th>Within</th>
<th>Outside</th>
<th>Reference Interval</th>
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</thead>
<tbody>
<tr>
<td>Cryptosporidium</td>
<td></td>
<td></td>
<td>Positive</td>
</tr>
<tr>
<td>Cyclospora cayetanensis</td>
<td>Negative</td>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>Entamoeba histolytica</td>
<td>Negative</td>
<td></td>
<td>Negative</td>
</tr>
<tr>
<td>Giardia duodenalis (AKA intestinalis &amp; lamblia)</td>
<td>Positive</td>
<td></td>
<td>Negative</td>
</tr>
</tbody>
</table>

**Diarrheagenic E. coli/Shigella**

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Status</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enteroaggregative E. coli (EAEC)</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Enteropathogenic E. coli (EPEC)</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Enterotoxigenic E. coli (ETEC) It/st</td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Shiga-like toxin-producing E. coli (STEC) stx1/stx2</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>E. coli O157</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Shigella/Enteroinvasive E. coli (EIEC)</td>
<td>Positive</td>
<td>Negative</td>
</tr>
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</table>

**Pathogenic Bacteria**

<table>
<thead>
<tr>
<th>Bacterium</th>
<th>Status</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter (jejuni, coli and upsaliensis)</td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Clostridium difficile (Toxin A/B)</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Plesiomonas shigelloides</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Salmonella</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Yersinia enterocolitica</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Vibrio (parahaemolyticus, vulnificus and cholerae)</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Vibrio cholerae</td>
<td>Negative</td>
<td>Negative</td>
</tr>
</tbody>
</table>

### SPECIMEN DATA

**Date Collected:** 02/06/2019  
**Date Received:** 02/07/2019  
**Date Reported:** 02/07/2019  
**Methodology:** FilmArray Multiplex PCR
Introduction

The GI Pathogen Profile, multiplex PCR can identify 22 pathogenic microbes using FDA-cleared, real-time PCR. The Centers for Disease Control (CDC) estimates that 350 million acute diarrheal illnesses occur annually, and notes that diarrheal syndromes are often similar in presentation. Viruses are the primary cause of acute diarrhea, and the least commonly tested. The identification of symptomatic pathogenic bacteria, viruses and parasites in a rapid-turn around format improves clinical decisions and treatment options. Due to increasing antimicrobial resistance, it is recommended that clinicians check for current antibiotic recommendations on the Centers for Disease Prevention and Control website http://www.cdc.gov/ for bacterial infections. There are no sensitivities offered on the Film Array GI Panel; a Bacteriology culture and sensitivities may be ordered from Doctor’s Data for patients with persistent symptoms.

The GI Pathogen Profile identifies four parasites. While many patients and clinicians wish to pursue natural alternatives when treating parasite infections, the University of Maryland Health Center (UMHC) notes that conventional treatments eradicate parasites more quickly and with fewer side effects. UMHC suggests that natural supports may be used in conjunction with conventional treatments, and to prevent parasites from growing. UMHC recommendations may be reviewed at http://umm.edu/health/medical/altmed/condition/intestinal-parasites. Because it may take time for all the dead cells from a resolved infection to clear from the gut, the GI Pathogen Profile may report positive findings up to 21 days after recovery.

Campylobacter (C. jejuni, C. coli, C. upsalensis)

Campylobacter is a leading cause of diarrheal disease in the United States. Most illnesses typically last one week, are self-limiting, and do not require treatment with antibiotics. The use of antibiotics for Campylobacter infection is controversial; as treatment may not shorten duration of symptoms, though children with C. jejuni dysentery may benefit from early antibiotic treatment. Persistent (> 7 days) or extreme symptoms (vomiting, high fever, bloody diarrhea) may require antibiotics. Antibiotics may be used to prevent septicemia in immunocompromised individuals. Azithromycin and erythromycin are currently the drugs of choice for treatment. Resistance to the fluoroquinolones has been observed. No treatment may be required for asymptomatic infections.

The usual mode of transmission of Campylobacter is fecal/oral or contaminated food or water, including consumption of unpasteurized milk undercooked poultry. Contaminated water consumed from mountain streams or rivers, and household pets may carry Campylobacter. The incubation period varies from 1-7 days. Campylobacter infection usually causes mild to moderate, often bloody, diarrhea. Other symptoms may include fever, cramping, nausea, headache, and/or muscle pain within 2 to 5 days of infection. Infection may mimic appendicitis, particularly in children. Complications, although rare, include reactive arthritis, hemolytic uremic syndrome, and infection of organs following septicemia. Serological and fecal studies have also indicated prior infection with C. jejuni in 20-40% of patients with Guillain-Barre syndrome, a rare acute peripheral neuropathy lasting up to four weeks. C. jejuni has also been associated with immunoproliferative small intestinal disease (also called alpha chain disease). Campylobacter infections may occasionally develop into toxic megacolon, a life-threatening condition.

References:

© 1999-2019 Doctor’s Data, Inc.
Javid, Mahmud H., MBBS. (2015)
Campylobacter Infections
Accessed 09/09/2015


Schreckenberger, Paul C. PhD. Personal communication.
Clinical Microbiology Laboratory, Loyola University, Chicago, IL.


Cryptosporidium

Cryptosporidiosis is a reportable disease in the U.S. Cryptosporidium infections occur via the fecal-oral route, from contaminated water (recreation or drinking), or by contact with infected animals (mammals, birds, reptiles). Children are most commonly infected. The incubation period averages seven days. Cryptosporidiosis symptoms in immunocompetent patients include watery diarrhea with occasional mucous, fever and crampy abdominal pain which lasts from five days to two weeks and is usually self-limited. The diarrhea may relapse in days or weeks after the initial infection, and diarrhea may last much longer in immunocompromised individuals. The parasite may continue to shed in stool for several weeks after the resolution of symptoms. Immunocompromised patients may have severe, persistent infections, which may affect the biliary tract or respiratory system, patients with HIV (human immunodeficiency virus) may be particularly vulnerable. Infections of the biliary tract may require surgical consult. In severe cases, patients may develop profuse, cholera-like diarrhea, which may result in malabsorption and dehydration, as severe infections may blunt the villi of the small intestines.

In addition to rehydration, anti-motility agents and anti-parasitic pharmaceutical agents may be used. Duration of diarrhea may be improved by nitazoxanide in children over 1 year old and adults (FDA-approved to treat Cryptosporidium). The effect of nitazoxanide in immunocompromised patients has not been established. Paromomycin, with or without azithromycin, may reduce symptoms but may not eradicate the parasite. Disruption of the enteric brush border during infections may result in secondary lactose intolerance. Nutritional support may include rehydration and lactose-free diet.

References:

Cabada, MD, MSc. (2015)
Cryptosporidiosis

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Shigella/Enteroinvasive Escherichia coli (EIEC)

There are several "pathotypes" of diarrheagenic E. coli and Shigella, which differ in disease mechanism, clinical presentation and severity of illness. Shigella-associated illnesses are reportable diseases in the U.S. Shigella infection may occur via the fecal oral route, or from contaminated food or water (recreation or drinking); Shigella is a common cause of food poisoning. Vegetables may be contaminated by irrigation water and flies may also transmit the pathogen. Breakouts may occur in daycare centers or nursing homes. The average incubation period for Shigella is 3-4 days.

Symptoms of Shigella infection include diarrhea (may be watery or bloody) with small-volume stools, fever, abdominal pain with tenesmus, fatigue and occasional vomiting. Symptoms usually last 5-7 days and may be self-limited in otherwise healthy patients; occasional, severe cases may last up to one month. Shigella infection may occur from any of the four species: S. sonnei, S. flexneri, S. dysenteriae, or S. boydii. Patients may become dehydrated and rehydration therapy (fluids and electrolytes); oral rehydration, and clear liquid, lactose (dairy)-free diet may be used until symptoms resolve. Antibiotics may be indicated for immunocompromised or infirm patients, or may be recommended for public health reasons (to prevent shedding and spreading of pathogen). Antibiotics may decrease course of illness by two days. Antibiotic resistance is increasing in Shigella species. Antibiotic treatment may be selected based upon culture and sensitivity results. Quinolone antibiotics may be indicated for immunocompromised patients.

Some Shigella infections may have serious complications such as post-infection arthritis, sepsis or hemolytic uremic syndrome (HUS). Anti-motility medication and antibiotic use is contraindicated with Shigella infections, as they increase the release of the bacterial toxins, and increase the risk of HUS. HUS symptoms include decreased urinary frequency, extreme fatigue, and sudden loss of normal pink color inside of eyelids (anemia). Patients with HUS may progress rapidly to renal failure, and hospitalization is usually required. Most cases of HUS resolve within weeks, but occasionally renal damage may be permanent. HUS complications can only occur if infection is due to S. dysenteriae and Shiga toxin is present. Seizure complications may occur in children with Shigella infections if high fever or electrolyte imbalances occur; they usually resolve spontaneously.

References:


Centers for Disease Control and Prevention

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Enterotoxigenic Escherichia coli (ETEC)

There are several “pathotypes” of diarrheagenic E. coli and Shigella, which differ in disease mechanism, clinical presentation and severity of illness. ETEC is a primary cause of traveler’s diarrhea, and is transmitted via the fecal-oral route through contaminated food or water. The average incubation period is approximately 40 hours. Symptoms of ETEC infection include profuse, watery diarrhea (free of polymorphonuclear (PMN) leukocytes) and abdominal cramping, occasionally with fever, nausea or vomiting, chills, anorexia, headache, muscle aches and bloating. A more severe form of ETEC may resemble cholera, with approximately 7 days of “rice-water” stools and dehydration. Most infections resolve within 4-7 days, but may take up to three weeks. Infections are usually self-limited and may only require supportive care and rehydration (fluids and electrolytes), however severe infections and immunocompromised individuals may require additional support. Antibiotics may shorten the duration of the diarrhea by 24-36 hours. For adults, antibiotics for E. coli may include doxycycline, trimethoprim/sulfamethoxazole, fluoroquinolones, and rifaximin; consult with a pharmacist for pediatric recommendations. Anti-motility agents are contraindicated in children.

References:

Centers for Disease Control and Prevention
1600 Clifton Road Atlanta, GA 30329-4027, USA
Enterotoxigenic E. coli (ETEC)
http://www.cdc.gov/ecoli/etec.html
Accessed 30 October 2015

Maddappa, Tarun, MD, MPH. (2015)
Escherichia Coli Infections
Accessed 29 October 2015

Todar, Kenneth, PhD.
Pathogenic E. coli (page 4)
Todar’s Online Textbook of Bacteriology http://textbookofbacteriology.net/e.coli_4.html
Accessed 30 October 2015

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Giardia duodenalis

Giardia duodenalis (aka Intestinalis & lamblia) a protozoan parasite, is a reportable disease in the U.S. Giardia infection may occur person-to-person via the fecal-oral route, and may be ingested in food or water (recreational or drinking water); Giardia may also infect dogs, cats, cattle, deer and beaver; Giardia may be resistant to chlorine water treatments. International travel to areas with poor sanitation may increase the risk of infection. Backpackers, hikers, campers and children in daycare may also be at increased risk of infection.

Giardia infection may be asymptomatic, but still infect others. The average incubation period is seven days. Symptoms of Giardia infection include diarrhea, gas, abdominal cramping, nausea, dyspepsia and floating, greasy stools. Dehydration may occur due to diarrhea, and the symptoms may result in weight loss, as symptoms may last from 2-6 weeks. Chronic diarrhea may lead to complications including dehydration, failure to thrive, malnutrition or lactose intolerance. Symptomatic patients may develop lactose intolerance during their illness and may need to remain dairy-free for several months after recovery; acquired lactose intolerance may persist in 20-40% of patients. If symptoms are severe, if the risk of spreading the infection is great (diapers, etc.) antibiotic treatment with metronidazole or tinidazole may be considered in addition to rehydration therapy. Pregnant patients may choose to avoid treatment during the first trimester, and may consider paromomycin as an alternate medication.

References:

Centers for Disease Control and Prevention (2015)
1600 Clifton Road Atlanta, GA 30329-4027, USA
Parasites - Giardia
http://www.cdc.gov/parasites/giardia/general-info.html
Accessed 05 November 2015

Mayo Foundation for Medical Education and Research (2015)
Giardia Infection (Giardiasis) Complications
http://www.mayoclinic.org/diseases-conditions/giardia-infection/basics/complications/CON-20024686
Accessed 05 November 2015

Nazer, Hisham, MB, BCh, FRCP, DTM&H (2014)
Giardiasis

Norovirus GI/GII

Norovirus GI/GII infection may occur via direct person-to-person contact, the fecal-oral route, by touching contaminated objects, or after the ingestion of contaminated food or water. Norovirus outbreaks have also occurred after recreational exposure in fresh water. Peak infection season occurs during the winter months in temperate climates. Evidence indicates that the ingestion of aerosolized vomit may also cause infection, and that occasionally virus may be shed prior to the onset of symptoms. Norovirus symptoms develop 12-48 hours after exposure; typical symptoms include acute-onset vomiting with watery, non-bloody diarrhea and abdominal cramps. Patients may also experience fever, headache, muscle aches, or fatigue. Symptoms
are self-limiting and usually resolve spontaneously within 48 hours, however illness may be severe for very young, very old or immunocompromised patients. Rehydration therapy may be used to replace fluids and electrolytes lost due to diarrhea, and symptomatic support for other symptoms may be used. Anti-emetics may provide relief from vomiting, but may be contraindicated in young children. Several small studies suggest that zinc supplements may reduce the severity and duration of viral gastrointestinal infections. Evidence indicates that probiotics may provide moderate clinical benefit in the treatment of watery diarrhea, especially in infants and young children. Studied probiotics strains include Lactobacillus casei GG and Saccharomyces boulardii.

References:

Centers for Disease Control and Prevention (2015)
1600 Clifton Road Atlanta, GA 30329-4027, USA
Norovirus
http://www.cdc.gov/norovirus/hcp/clinical-overview.html
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Accessed 09 November 2015

Tablang, Michael Vincent F., MD (2014)
Viral Gastroenteritis
http://emedicine.medscape.com/article/176515-overview
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http://www.cdc.gov/norovirus/hcp/clinical-overview.html
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