Giardia

Presented by Brianne Dettrich
History of Giardia

- Von Leeuwenhoek observed *Giardia intestinalis* by a microscope in 1681, in his own diarrheal stool.
- It was further described by Vilem Dusan Lambl in 1859 and by Alfred Giard in 1895. The name *Giardia lamblia* was then created in honor of their further discovery of this parasite in 1915.
- 1950’s- RC Rendtorff did a study to identify infection in man after the introduction of small numbers of giardia cysts.
- 1960’s- JD Karapetyan was able to culture *G. intestinalis* for the first time.
- For 200 years it was considered a harmless or weak intestinal pathogen.
- 1970’s- Where its role as a pathogenic organism became recognized when community outbreaks started happening and the presence of giardia in travelers returning from endemic countries.
- Was the FIRST protozoan parasite to be described.
Giardia in action ...

- Giardia Case study:

  - Local Sherwood family went on a trip to Great Wolf lodge on November 26-27, 2013. Whole family had a great time and left the waterpark feeling great.

  - On December 20th, grandmother and grandfather came to visit family for Christmas. Grandmother stated to feel very tired, exhausted and had diarrhea starting December 31st, 2013. (incubation period of 11 day)

  - Grandmother proceeded to deal with her symptoms and thought it was just a little food poisoning. Went home to Colorado on January 6th and proceeded to visit this doctor on January 7th.

  - Diagnosed after providing a stool sample on January 8th with giardia. Was prescribed Antibiotics (metronidazole 3 x daily for 7 days.)

  - Grandmother notified family that she had giardia which was most likely passed to her from the 3 year old little boy potty training and the 10 year old special needs daughter who wears pull-ups.

  - All children where asymptomatic showing no abdominal pain or diarrhea. Owen the 3 year old started to show signs with floating grainy feces on January 1st, he is a very picky eater so we though it was just dehydration and lack of adequate nutrients.

  - All three children where tested using stool samples and all tested positive. Treated with a liquid compound antibiotic and had to do the antibiotic twice to rid them of giardia.

*** Taking precaution parent called Great wolf lodge to report the diagnosis and turns out they had 5 other report cases of visitors who came to the water park on the same weekend.

Facts to the case: Special Needs daughter has a neurological disease called retts syndrome which causes her to intake water while swimming large amounts at times and also during bath time which may be the source of the transmission between all children and grandmother, since the kiddos sometime take a bath together.
Giardia is a ......

- PATHOGENIC FLAGELLATED PROTOZOA
- Giardia cysts are small, compact and contain four nuclei (the inactive stage)
- Giardia Trophozoite (active stage)
  - unique symmetrical heart shape with organelles positions that it looks like a face
  - 4 pairs of flagella emerge from ventral surface which is concave and acts like a suction cup for attachment to a substrate.
- Has a complex microtubule cytoskeleton which is the etiological agent of giardiasis.
  - motility
  - cell division
  - attachment
  - encystation/excystation
  - intracellular transport
What is Giardia?

***Also called Giardia intestinalis, Giardia lamblia, or Giardia duodenalis***

***a microscopic parasite that causes the diarrheal illness known as giardiasis.***

***can be found on surfaces of soil, food or water that has been contaminated with feces.***

***Giardia is protected by an outer shell that allows it to survive outside the body for long periods of time and makes it tolerant to chlorine disinfection.***

***Incubation time is 1-2 weeks after being in contact with giardia***

Diagram from book shows the structure of a giardia parasite including the cyst and trophozoite.
Description of stages and Virulence Factors

**Cysts**
- ingestion of cyst where excystation occurs in the stomach when cyst is introduced to acid and pancreatic enzymes
- has cytoskeleton which protects the cyst from chlorine disinfectant
- 4 nuclei when mature
- 10 u in length

**Factors:**
- Ventral disc-adhesion
- Flagella- motility
- Capsule- protect outside of the body

**Trophozoites**
- pass into the small bowel and doubles within 9-12 hours
- moves to large bowel and encystation occurs while comes in contact with bile salts and neutral pH
- teardrop-shaped
- measures 9-21 micrometers long by 5-15 micrometers wide
- Has convex dorsal surface and a flat ventral surface that contains the ventral disk (a rigid cytoskeleton composed of microtubules and microribbons)
- 4 pairs of flagella (AID THE PARASITE IN MOVING)
- Has two symmetric nuclei
- Ventral disk, acts as a sucking disc providing the parasite with powerful adhesion, catching, and holding abilities
PATHOPHYSIOLOGY
What it does in the host...

- induced loss of intestinal brush border surface area
- villus flattening
- inhibition of disaccharidase activities
- overgrowth of enteric bacterial flora
- DAMAGE TO INTESTINAL EPITHELIUM
- MUCOSAL INFLAMMATION STRUCTURAL AND FUNCTIONAL ABNORMALITIES
Transmission

Cysts are the transmission agents in Giardia

- Spread from person to person contact
  - close contact with infected person
  - child to their caregiver in childcare setting
- Spread by fecal-oral route
- Results from the ingestion of *Giardia* cysts through the consumption of fecal contaminated food or water
- Can also be transmitted by contact with animals fecal matter
How does a Person catch Giardia?

- First, The Cysts are resistant forms and are responsible for transmission of giardiasis which can be found in feces.
- Second, The cysts are hardy and can survive several months in cold water. Infection occurs by the ingestion of cysts in contaminated water, food, or by the fecal-oral route.
- Third, In the small intestine, excystation releases trophozoites which is the active state that causes symptoms to occur.
- Forth, Trophozoites multiply by longitudinal binary fission, remaining in the lumen of the proximal small bowel where they can be free or attached to the mucosa by a ventral sucking disk.
- Finally, Encystation occurs as the parasites transit toward the colon. The cyst is the stage found most commonly in nondiarrheal feces which is the inactive stage and can live for a prolonged amount of time outside the body.

Because the cysts are infectious when passed in the stool or shortly afterward, person-to-person transmission is possible.
Symptoms of giardiasis normally begin 1 to 3 weeks after becoming infected. They can last for 2 to 10 weeks sometimes longer.

**Having ______ ...**

You may have Giardia?

- Abdominal pains
- Diarrhea of long durations
- Stools with a greasy, foul-smelling quality to them
- Stools that float
- Gas
- Dehydration
- Upset stomach or nausea/vomitting

**How is it diagnosed?**

- Doctor will ask for a stool sample to test
- Because it can be difficult to test for giardiasis multiple collections of stools from different days is needed to test for the appearance of giardia cysts
Treatment: How to rid Giardia

Medical treatment is needed if symptoms do not subside on their own within 2 to 6 weeks

- **Drugs:**
  - Tinidazole
  - Metronidazole
  - Nitazoxanide

Antibiotics given to humans who may have the presence of giardia in them.

- The is no human vaccine available but there is a vaccine available for animals.

<table>
<thead>
<tr>
<th>TABLE 1. Drugs for treatment of giardiasis*</th>
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<tbody>
<tr>
<td>Drugs (listed alphabetically)</td>
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<td>---------------------------------</td>
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<tr>
<td><strong>Adults (nonpregnant)</strong></td>
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<td>Albendazole</td>
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<td>Furazolidone</td>
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<td>Paromomycin</td>
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<td>Quinacrine</td>
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<td>Tinidazole</td>
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<td><strong>Pregnant Women</strong></td>
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<td>Paromomycin</td>
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<td><strong>Children</strong></td>
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<td>Tinidazole</td>
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<tr>
<td><strong>Refractory Cases</strong></td>
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<td>Metronidazole AND Quinacrine</td>
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Table describing drug and dosages used to treat giardia.
Stop the spread of Giardia:

ways of prevention

► Practice good hygiene
  ~ Wash hands all the time all day long

► Avoid water that may be contaminated
  ~ DO NOT swallow water while swimming in pools, hot tubes, lakes, ocean, etc.
  ~ Infection seems to be higher in summer months because of this use of water sources

► Avoid eating food that may be contaminated
  ~ use safe uncontaminated water to wash all food that is to be eaten raw
  ~ avoid eating uncooked or raw food when traveling to countries that have poor food and water treatment.

► Prevent contact and contamination with feces during sexual intercourse
  ~ take proper caution to prevent any contact with feces during intercourse

► Clean up after ill pets and people
  ~ Hard to completely eliminate from environment so clean and disinfect home and all items that may come in contact with someone who has diarrhea
Giardia throughout the US and Oregon

- During 2009-2010, the total number of reported cases of giardiasis increased 1.9%, from 19,562 for 2009 to 19,927 for 2010 in the United States.

- According to 2003-2005 data from the Centers for Disease Control and Prevention, the greatest number of reported cases occurred among children aged 1-4 and 5-9 years and adults aged 35-44 years. (Nazer)

- During 2013, 96% of the cases in Oregon were reported as “sporadic” and 2% as household associated with one outbreak case reported.

- It infects nearly 2% of adults and 6% to 8% of children in developed countries worldwide.

- Nearly 33% of people in developing countries have had giardiasis.

Chart showing the decline in giardia cases from 2010-2013 with a higher average of cases in Oregon then in the US each year.
In Oregon 2013, chart showing cases of *giardia* are higher during the summer months.
How does *Giardia* impact our lives?

- *Giardia* is a major diarrheal disease found thought-out the world.
- It is the most commonly identified intestinal parasite in the United States and the most common intestinal parasite isolated worldwide.
- This organism can be found in 80% of raw water supplies and is the leading cause of chronic diarrhea and growth retardation in children of developing countries.

Weather you want to travel the world and experience all this world has to offer or adopt a child from a developing country, you are at risk of contracting *Giardia*.

Knowing how this parasite works and evolves is key to staying on top of how to treat this disease.
References


History of Giardia and structure


Charts and statistics about Oregon and cases of Giardia


Detailed information about symptoms, structure of giardia, and prevention and treatment of giardia. Took figure 20.9 from book


Drug treatment chart


Pictures of the men who discovered giardia


What is giardia information, factual descriptive information about giardia


Important information about how giardia effects the US and world along with historical facts about giardia


Life cycle diagram and information about how giardia is transmitted and the whole cycle in the body from cysts to trophozoite


Surveillance information about cases in the US