

ENTERIC PARASITES 101

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Enteric Parasites Overview

- Types of Parasites:
 - Protozoa: Single-celled, microscopic organisms that can perform all necessary functions of metabolism and reproduction. Some protozoa are free-living, while others parasitize other organisms for their nutrients and life cycle.
 - Helminths: A large, multicellular organism (worm) that is generally visible to the naked eye in its adult stages. Helminths can be free-living or parasitic.
 - Nematodes: Roundworms
 - Trematodes: Flukes
 - Cestodes: Tapeworms



Urgency Reporting Requirements

☎ = Report immediately by telephone. ☒ = Report within 1 working day of identification. Ⓞ = Report within 7 calendar days from time of identification.

REPORTABLE DISEASES

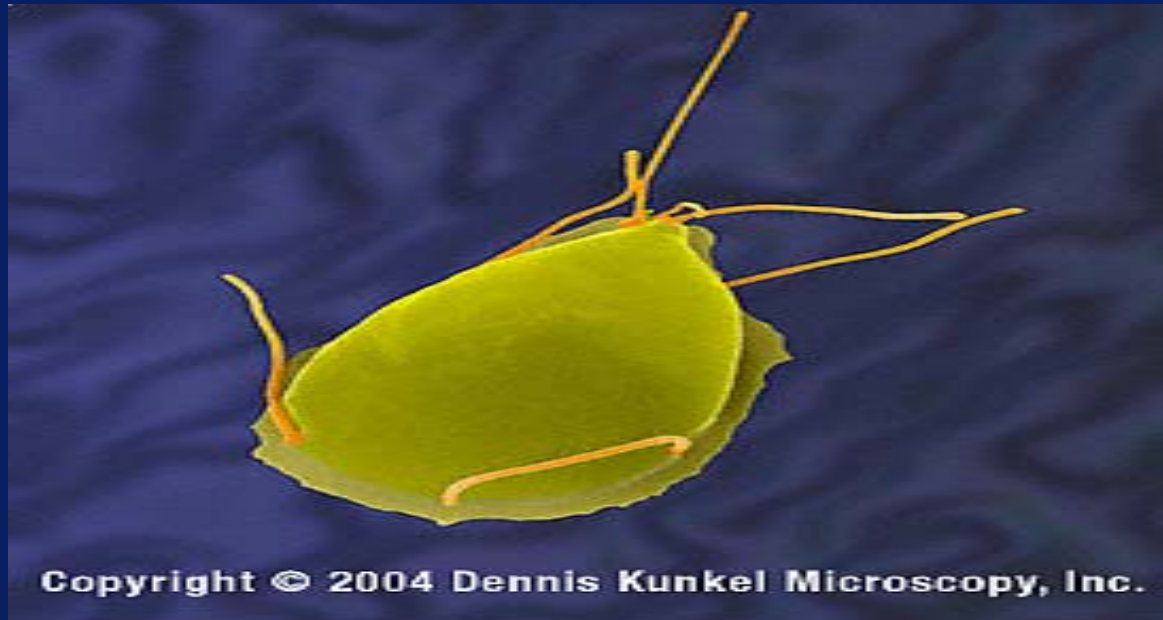
- Ⓞ Acquired Immune Deficiency Syndrome (AIDS) ■
 - ☒ Amebiasis
 - ☎ Anthrax
 - ☎ Avian Influenza, Human
 - ☒ Babesiosis
 - ☎ Botulism: Infant, Foodborne, or Wound
 - ☎ Brucellosis
 - ☒ Campylobacteriosis
 - Ⓞ Chancroid ■
 - Ⓞ Chlamydial Infections, including lymphogranuloma venereum (LGV) ■
 - ☎ Cholera
 - ☎ Ciguatera Fish Poisoning
 - Ⓞ Coccidioidomycosis
 - ☒ Colorado Tick Fever
 - ☒ Conjunctivitis, Acute Infections of the Newborn, specify etiology
 - Ⓞ Creutzfeldt-Jakob Disease (CJD) and other Transmissible Spongiform Encephalopathies (TSE)
 - ☒ Cryptosporidiosis
 - Ⓞ Cysticercosis or Taeniasis
 - ☎ Dengue
 - ☎ Diarrhea of the Newborn, outbreaks only
 - ☎ Diphtheria
 - ☎ Domoic Acid (Amnesic Shellfish) Poisoning
 - Ⓞ Ehrlichiosis
 - ☒ Encephalitis, specify etiology: Viral, Bacterial, Fungal, Parasitic
 - ☎ *Escherichia coli*: shiga toxin producing (STEC) including *E. coli* O157
 - ☒ Foodborne Disease:
 - ☎ 2 or more cases from separate households with same suspected source
 - Ⓞ Giardiasis
 - Ⓞ Gonococcal Infections ■
 - ☒ *Haemophilus influenzae*, invasive disease (only report cases less than 15 years of age)
 - ☎ Hantavirus Infections
 - ☎ Hemolytic Uremic Syndrome
 - ☎ Hemorrhagic Fevers, Viral (e.g., Crimean-Congo, Ebola, Lassa and Marburg viruses)
 - ☒ Hepatitis A
 - Ⓞ Hepatitis B, specify Acute or Chronic
 - Ⓞ Hepatitis C, specify Acute or Chronic
 - Ⓞ Hepatitis D (Delta)
 - Ⓞ Hepatitis, Other/Acute
 - Ⓞ Human Immunodeficiency Virus (HIV) ■ (§2641-2643)
 - Ⓞ Influenza deaths (Only report cases less than 18 years of age)
 - Ⓞ Kawasaki Syndrome (Mucocutaneous Lymph Node Syndrome)
 - Ⓞ Legionellosis
 - Ⓞ Leprosy (Hansen's Disease)
 - Ⓞ Leptospirosis
 - ☒ Listeriosis
 - Ⓞ Lyme Disease
 - ☒ Malaria
 - ☒ Measles (Rubeola)
 - ☒ Meningitis, specify etiology: Viral, Bacterial, Fungal, or Parasitic
 - ☎ Meningococcal Infections
 - Ⓞ Mumps
 - ☎ Paralytic Shellfish Poisoning
 - Ⓞ Pelvic Inflammatory Disease (PID) ■
 - ☒ Pertussis (Whooping Cough)
 - ☎ Plague, Human or Animal
 - ☒ Poliomyelitis, Paralytic
 - ☒ Psittacosis
 - ☒ Q Fever
 - ☎ Rabies, Human or Animal
 - ☒ Relapsing Fever
 - Ⓞ Rheumatic Fever, Acute
 - Ⓞ Rocky Mountain Spotted Fever
 - Ⓞ Rubella (German Measles)
 - Ⓞ Rubella Syndrome, Congenital
 - ☒ Salmonellosis (other than Typhoid Fever)
 - ☎ SARS (Severe Acute Respiratory Syndrome)
 - ☎ Scabies (Atypical or Crusted) ★
 - ☎ Scombroid Fish Poisoning
 - ☎ Shiga Toxin (detected in feces)
 - ☒ Shigellosis
 - ☎ Smallpox (Variola)
 - Streptococcal Infections:
 - ☎ Outbreaks of any type
 - ☒ Individual case in a food handler
 - ☒ Individual case in a dairy worker
 - ☒ Invasive Group A Streptococcal Infections including Streptococcal Toxic Shock Syndrome and Necrotizing Fasciitis ★ (Do not report individual cases of pharyngitis or scarlet fever.)
 - Ⓞ *Streptococcus pneumoniae*, Invasive★
 - ☒ Syphilis ■
 - Ⓞ Tetanus
 - Ⓞ Toxic Shock Syndrome
 - Ⓞ Toxoplasmosis
 - ☒ Trichinosis
 - ☒ Tuberculosis ■
 - ☎ Tularemia
 - ☒ Typhoid Fever, cases and carriers
 - Ⓞ Typhus Fever
 - ☎ Varicella, Fatal Cases
 - Ⓞ Varicella, Hospitalized Cases (do not report cases of herpes zoster or shingles)
 - ☒ Vibrio Infections
 - ☒ Water-Associated Disease (e.g., Swimmer's Itch or Hot Tub Rash)
 - ☒ West Nile Virus (WNV) Infection
 - ☎ Yellow Fever
 - ☒ Yersiniosis
- ☎ OCCURRENCE OF ANY UNUSUAL DISEASE**
- ☎ OUTBREAKS OF ANY DISEASE** (Including diseases not listed in §2500). Specify if institutional diseases and/or open community.

GIARDIASIS



Description

- Giardiasis is a diarrheal illness caused by a microscopic protozoal parasite, *Giardia lamblia*



Transmission

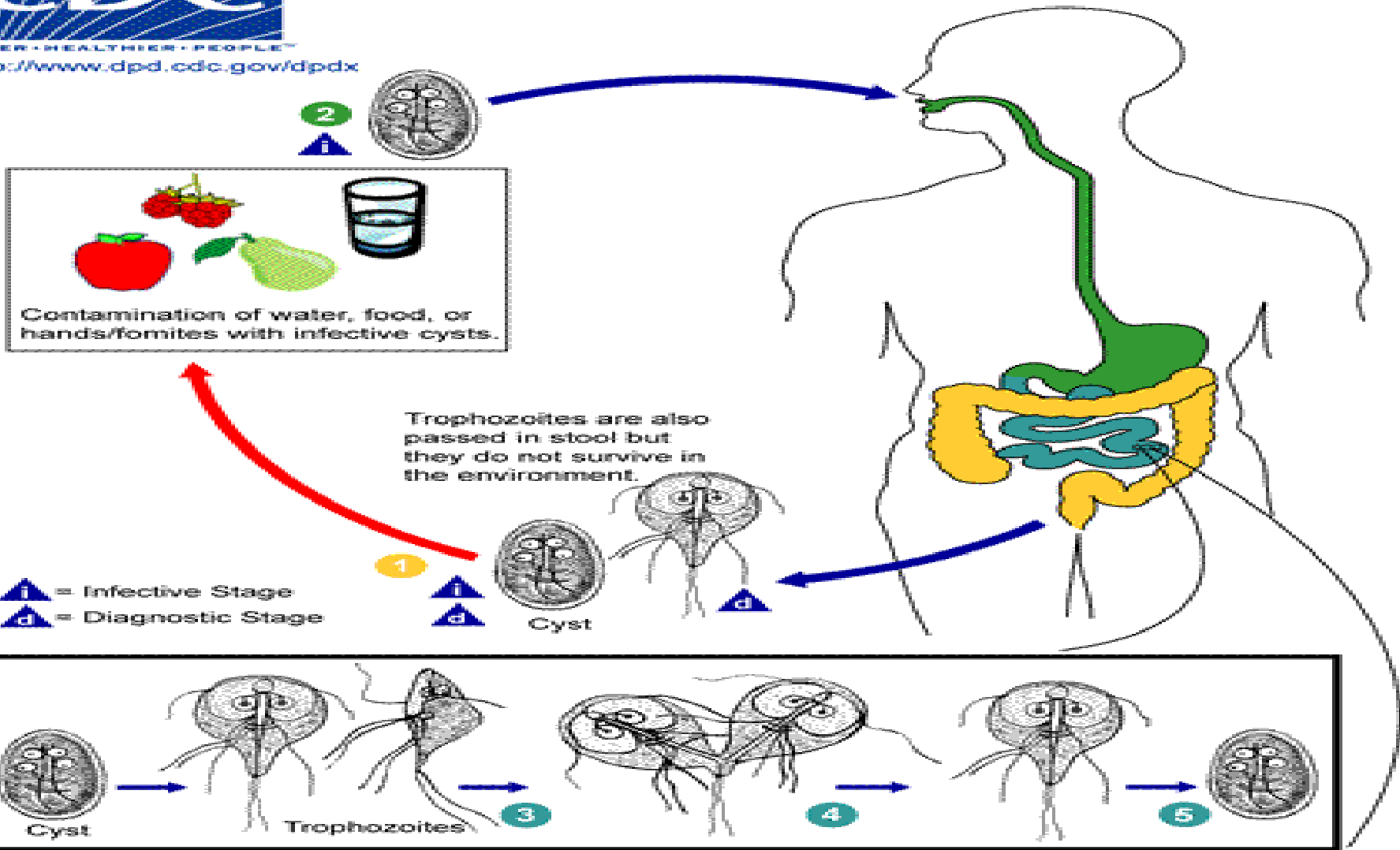
- The parasite lives in the intestine of an infected host and cysts containing the organism can be released in a bowel movement of an infected human or animal
- Giardia is found on surfaces or in soil, food, or water that has been contaminated with the feces from infected humans or animals
- Humans become infected upon accidental consumption of the parasite



Giardia lamblia

CDC

SAFER • HEALTHIER • PEOPLE™
<http://www.dpd.cdc.gov/dpdx>



Transmission

- Common sources of infection include:
 - Surfaces such as bathroom fixtures, changing tables and toys contaminated with infected feces
 - Drinking water or ice made from sources contaminated with infected feces including lakes, stream or wells
 - Swallowing water from recreational sources including swimming pools, hot tubs and fountains contaminated with infected feces
 - Eating uncooked food contaminated with the parasite



Giardia lamblia

Acute Illness

- *G. lamblia* cysts are highly infectious, and as few as 10 cysts can cause an infection in an individual.
- Average incubation period (ingestion of cysts to first symptoms): One week
- Average duration of infection: 2-6 weeks (if left untreated)



Giardia lamblia

- Symptoms Include:
 - Gastrointestinal Symptoms:
 - Sudden onset of explosive watery diarrhea, abdominal cramps
 - Foul flatus
 - Vomiting
 - Stools become malodorous, mushy, and greasy.
 - Watery diarrhea may alternate with soft stools or even constipation
 - Stools do not contain blood or pus.
 - Upper GI symptoms including:
 - Cramping
 - Nausea
 - Anorexia
 - Bloating
 - Substernal burning
 - Acid indigestion



Giardia lamblia

Acute Illness

- Constitutional symptoms are also common including:
 - Fatigue
 - Malaise
 - Weight loss
 - Weight loss occurs in more than 50% of patients and averages 10 pounds per person
- Chronic illness may occur with adults presenting with long-standing malabsorption syndrome and children with failure to thrive.



Giardia lamblia

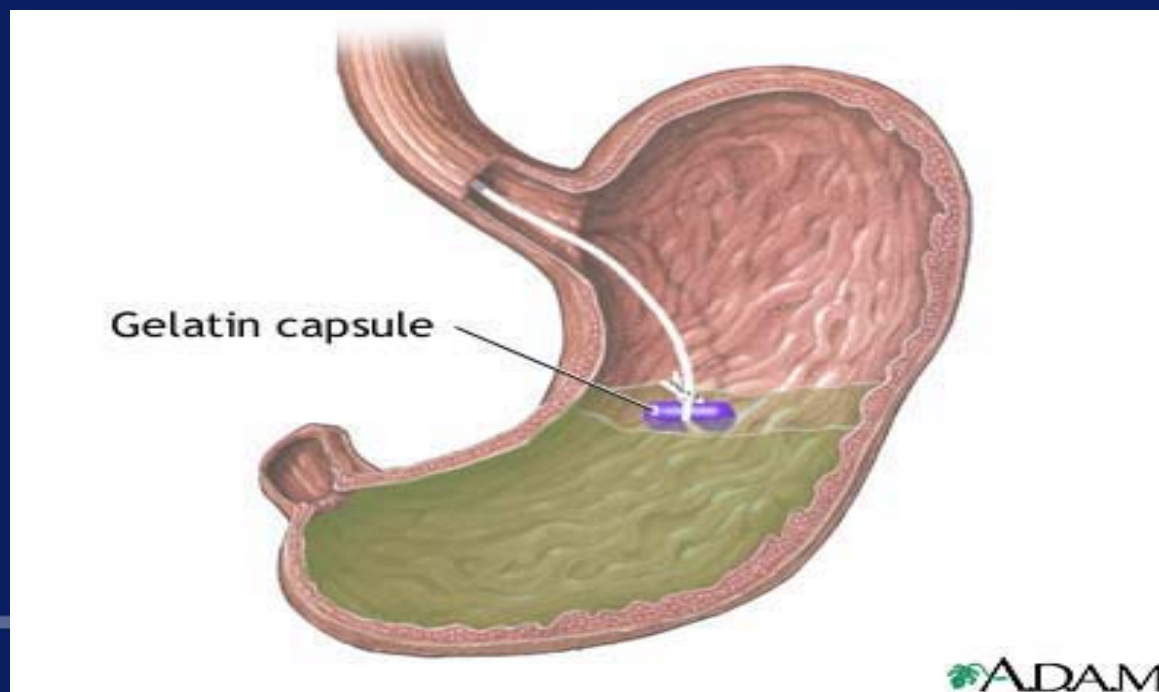
Diagnosis

- Microscopically:
 - by identifying cysts in stool samples using trichrome or iron hematoxylin staining.
 - More than one sample is recommended (at least 3 stool samples with two days between each), since the presence of cysts in the stool can be highly irregular, and cysts may not be present until a week after symptoms appear.
- An Enzyme-Linked Immunosorbent Assay (ELISA)
 - may be used to detect *Giardia* antigens in the stool, and is commercially available (highly sensitive).



Diagnosis

- String test (used for difficult to diagnose cases)
 - A patient swallows a gelatin-coated capsule with a string attached, and when it is passed into the small intestine, trophozoites stick to the string.
 - The string is then removed and examined microscopically for the trophozoites.





CONTROL OF CASE, CONTACTS & CARRIERS

Public Health Nursing Home Visit Protocol:
Home visit as necessary – a face to face interview is conducted as necessary.

Refer to "Public Health Nursing Home Visit AS NECESSARY (HVN) Algorithm" (B-73 Part IV Public Health Nursing Home Visit Protocol).

Investigation is required for outbreaks and for single cases. Initiate investigation within 3 days.

CASE:

1. **Sensitive Occupation:** If symptomatic, remove from work or day care until asymptomatic and on therapy. Release specimens are not mandated.

For cases in day care, question operator about symptoms among staff and other children. Symptomatic children and staff should be excluded, screened, and treated if necessary.

Asymptomatic persons should not be screened since treatment is not indicated for asymptomatic carriers.

2. **Non-sensitive Occupation or Situation:** Case may be closed without release specimens provided household contacts are not symptomatic and in sensitive occupations.

CONTACTS:

Household members or persons who share a common-source exposure should be tested only if symptomatic. If positive, handle as a case. If negative or asymptomatic, no restrictions.

CARRIER:

Refer to treatment above. Release as for case.

PREVENTION-EDUCATION

1. Stress hand washing and personal hygiene.
2. Dispose of feces properly.
3. Boil or disinfect water (chlorine or iodine tablets) of unknown potability, e.g., during

international travel and when hiking or camping.

4. Advise about the risk of anal intercourse and oral-anal sexual practices.
5. Stress importance of proper hygiene regarding handling and disposal of pet feces.
6. Stress bathing before recreational water use, avoid accidental swallowing of recreational water.

DIAGNOSTIC PROCEDURES

1. Microscopic:

Container: Feces-Parasite.

Laboratory Form: TEST REQUISITION FORM H-3021

Examination Requested: Giardiasis. Check appropriate boxes on laboratory form.

Material: Feces. Follow collection instructions provided with container.

Storage: Do not refrigerate; protect from overheating.

Remarks: Mix thoroughly with PVA preservative. Do not collect specimen(s) for 7-10 days after barium, mineral oil, bismuth, antibiotics, antimalarials, or antidiarrheal preparations such as kaolin have been ingested.

2. Antigen Detection:

Container: Feces-Parasite

Laboratory Form: TEST REQUISITION FORM H-3021

Examination Requested: Giardiasis. Check appropriate boxes on laboratory form.

Material: Feces in 10% formalin.

Storage: Do not refrigerate; protect from overheating.

Giardia lamblia

Treatment

- Most infections are self-limited and will clear within 4 weeks.
- Prescription drugs available for treatment:
 - Metronidazole
 - Tinidazole
 - Nitazoxanide (has provided some encouraging results in the management of giardiasis in children)



Giardia lamblia

Epidemiology

- *Giardia* is one of the most common intestinal parasites in the world.
- There are estimates that there may be as many as 2.5 million cases each year of *Giardia lamblia* in the US alone.
- The parasite poses a serious threat in less developed countries, and exists at very high prevalence rates in places with poor water sanitation.



Giardia lamblia

Epidemiology

Commonly associated with:

- Hikers and backpackers:
 - Getting diarrhea after drinking untreated water in the wilderness.
- Daycare and Nursery settings
 - Outbreaks can be focused in these locations infecting children under 5 years old--and their caregivers--the most.
- International travelers
 - Recent immigrants have the same risk factors as international travelers
- Recreational water users



Giardia lamblia

Prevention

For an infected individual:

- Hand washing with soap and water after using the toilet, handling childrens' diapers and before handling food
- Restriction of swimming activities in recreational water while a person has diarrhea and for 1 week after diarrhea stops



Giardia lamblia

Prevention

To help prevent infection from occurring:

- Practice good hygiene
- Avoid food or water that might be contaminated
 - Untreated water from lakes, rivers and ponds
- If necessary to consume potentially contaminated water, boil for at least 1 minute or treat with chlorination or iodination before consumption
 - though due to the amount needed of these chemicals to properly treat, this method can be less effective



CRYPTOSPORIDIOSIS



Cryptosporidium parvum

- Cryptosporidiosis (aka “Crypto”) is caused by the intracellular protozoal parasite *Cryptosporidium parvum*.
- It is most commonly found in contaminated water, food, or soil.



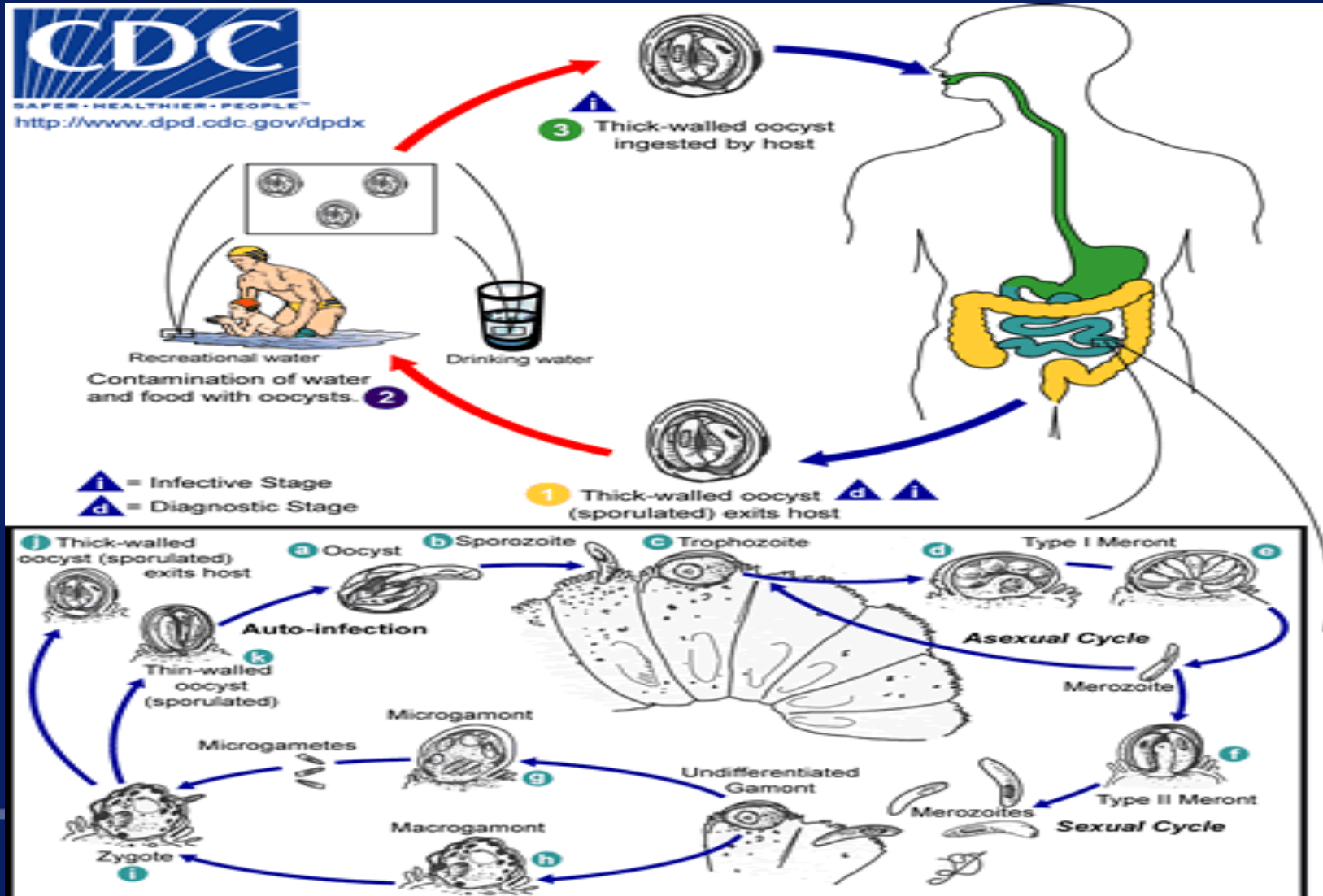
Cryptosporidium parvum

Transmission

- Crypto lives in the intestine of infected humans or animals and the parasites are shed in the stool of an infected individual
- Crypto is found on surfaces or in soil, food, or water that has been contaminated with the feces from infected humans or animals
- Humans become infected upon accidental consumption of the parasite



Cryptosporidium parvum



Cryptosporidium parvum

Acute Illness

- Average incubation period: 7 days (but can range from 1 to 12 days).
- Duration: Symptoms can last anywhere from a few days to a few weeks.



Cryptosporidium parvum

Acute Illness

- The most common symptom is watery diarrhea.
- Other possible symptoms include:
 - Dehydration
 - Weight loss
 - Stomach cramps or pain
 - Fever
 - Nausea
 - Vomiting
 - Coughing
 - Low-grade fever



Cryptosporidium parvum

Acute Illness

- Although this may be the norm, there are still many patients with Cryptosporidiosis that are asymptomatic.
- It is possible that an infection caused by *Cryptosporidium* may affect respiratory, tracheal, and intestinal tracts.



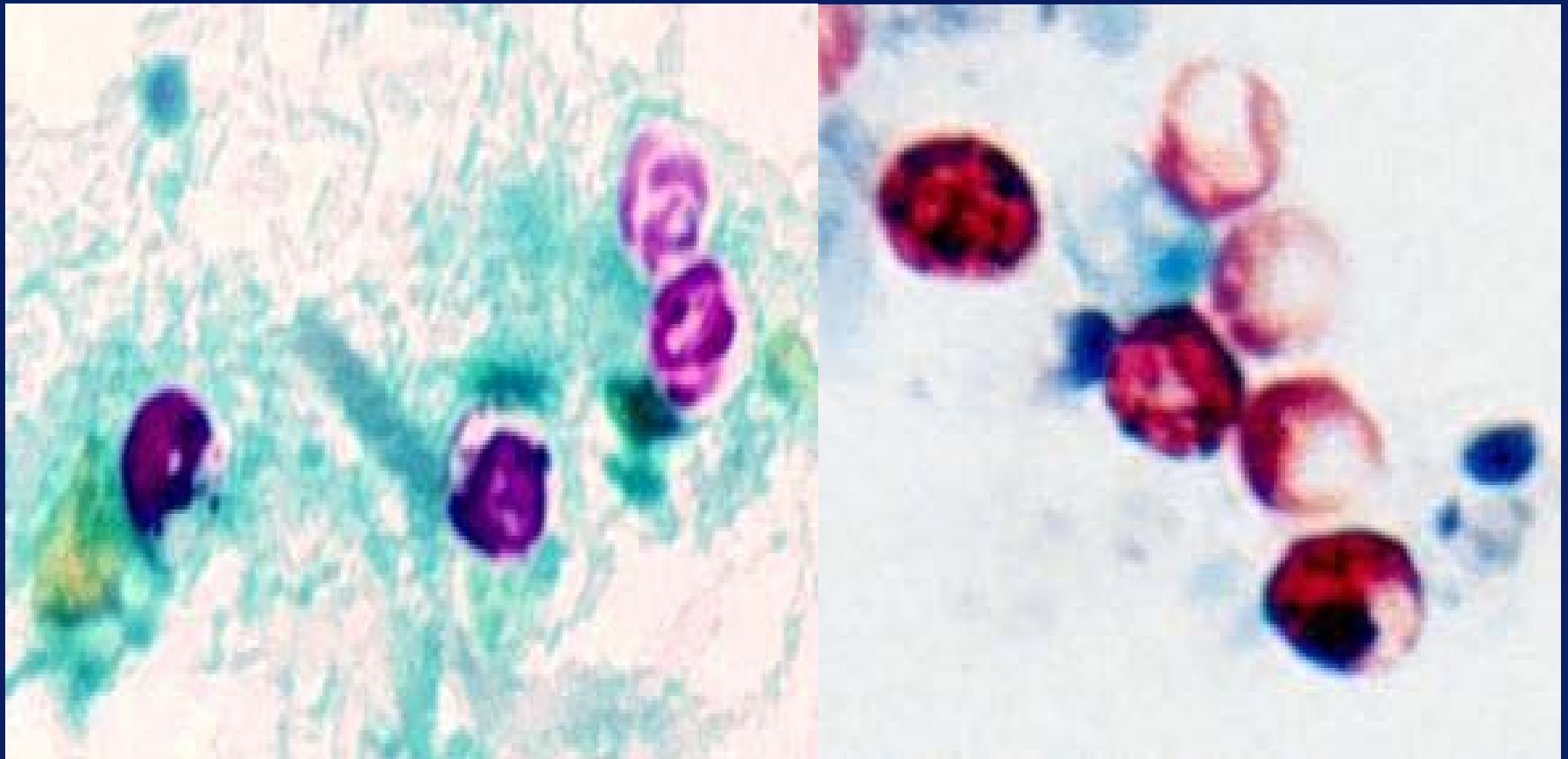
Cryptosporidium parvum

Diagnosis

- Microscopic examination of stool after special concentration and staining
- Detection of various life cycles in intestinal biopsy
- Antigen Detection



Cryptosporidium parvum Diagnosis





CASE:

1. **Sensitive Occupation:** Restrictions should be individualized based on case's hygiene and severity of symptoms. If severely symptomatic, remove from SOS until diarrhea is reduced. Clearance specimens are not mandated. Chronically immunosuppressed patients are unlikely to recover; permanent removal from SOS may be appropriate only for cases that demonstrate poor hygiene and no ability to improve their practice.
2. **Non-sensitive Occupation or Situation:** Case may be closed without release specimens, provided household contacts are not symptomatic and in sensitive occupations.

CONTACTS:

Household members or persons who share a common source exposure should be tested only if symptomatic. If positive, handle as a case. If negative or asymptomatic, no restrictions.

CARRIERS:

Immunosuppressed patients remain infected chronically.

PREVENTION-EDUCATION

1. Stress hand washing and personal hygiene.
2. Advise about increased risk with genital-anal and oral-anal sex.
3. Dispose of feces in a safe, sanitary fashion.
4. Take precautions with food and water when traveling to endemic areas.
5. Advise regarding risk associated with colonic irrigation.
6. Protect water supply from fecal contamination.

DIAGNOSTIC PROCEDURES

1. Microscopic:

Container: Feces-Parasite.

Laboratory Form: Test Requisition Form H-3021 (Rev. 9/07)

Examination Requested: Cryptosporidium.
Check appropriate boxes on laboratory form.

Material: Feces. Follow instructions provided with container.
Amount: 20-30 ml liquid stool.

Storage: Do not refrigerate; protect from overheating.

Remarks: Mix thoroughly with PVA preservative. Do not collect specimen(s) for 7-10 days after barium, mineral oil, bismuth, antibiotics, antimalarials or antidiarrheal preparations such as kaolin have been ingested.

2. Antigen Detection:

Container: Feces-Parasite.

Laboratory Form: Test Requisition Form H-3021 (Rev. 9/07) or online request form.

Examination Requested: Cryptosporidium.

Material: Feces in 10% formalin.

Amount: 20-30 ml.

Storage: Do not refrigerate; protect from overheating.]



Cryptosporidium parvum

Treatment

- Fluid and electrolyte replacement
 - To manage rapid fluid loss due to diarrhea
- Prescription drugs:
 - Nitazoxanide to treat diarrhea (for immunocompetent patients)
 - The effectiveness of nitazoxanide in immunosuppressed persons is unclear.
- Infection in healthy, immunocompetent persons is self-limited.
- Immunocompromised persons and those in poor health are at highest risk for severe illness.



Cryptosporidium parvum

Epidemiology

- Since the first reports of human cases in 1976, *Cryptosporidium* has been found worldwide.
- Outbreaks of cryptosporidiosis have been reported in several countries, the most remarkable being a waterborne outbreak in Milwaukee in 1993, that affected more than 400,000 people.



Cryptosporidium parvum

Epidemiology

- People at greater risk of exposure:
 - Children who attend day care centers
 - Child care workers
 - International travelers
 - Hikers and backpackers
 - Recreational water users
 - People who handle infected cattle
 - Recent immigrants
 - Those engaging in oral-anal sex
 - Those engaging in colonic irrigation



Cryptosporidium parvum

Prevention

- Cryptosporidiosis control involves:
 - Effectively purifying water
 - Use of water filtration systems (best method) with a pore size of 1 micron or less.
 - Use of appropriate levels of chemical treatments
 - Notifying the public when and where an outbreak is present
 - Research to develop a vaccine
 - There is no vaccine currently available for humans.



Cryptosporidium parvum

Prevention - Obstacles

- *Cryptosporidium* parasites are very small and resistant to many conventional purifying methods such as chlorination, ozonation, and UV exposure
- The oocysts have hard shells that are not easily damaged by chlorine.
 - This is why swimming in a contaminated recreational facility is especially dangerous.



TRICHINELLOSIS



Trichinella spp.

- Trichinellosis (trichinosis) is caused by nematodes (roundworms) of the genus *Trichinella*.
- In addition to the classical agent *T. spiralis* (found worldwide in many carnivorous and omnivorous animals), several other species of *Trichinella* are now recognized, including:
 - *T. pseudospiralis* (mammals and birds worldwide)
 - *T. nativa* (Arctic bears)
 - *T. nelsoni* (African predators and scavengers)
 - *T. britovi* (carnivores of Europe and western Asia)

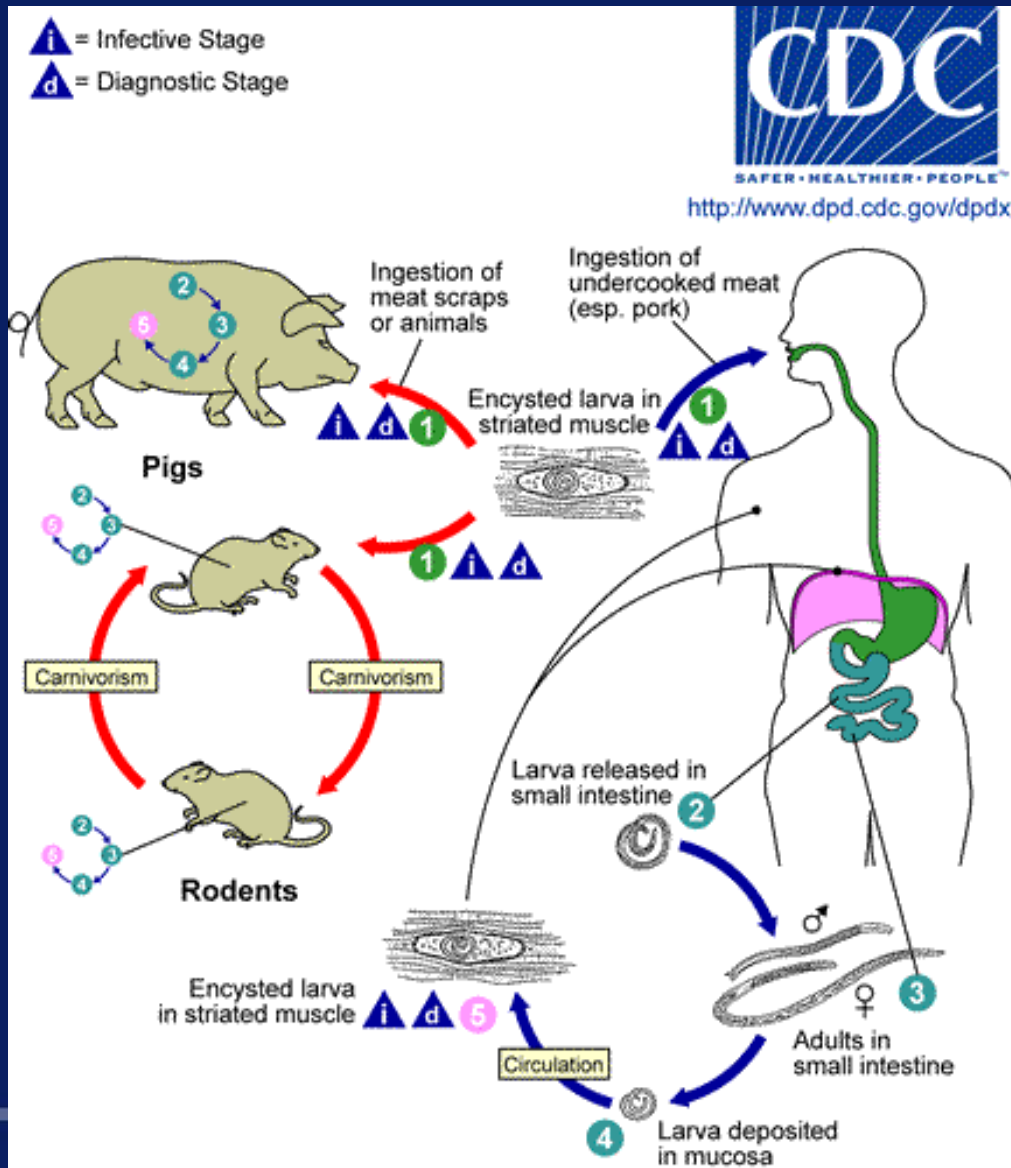


Transmission

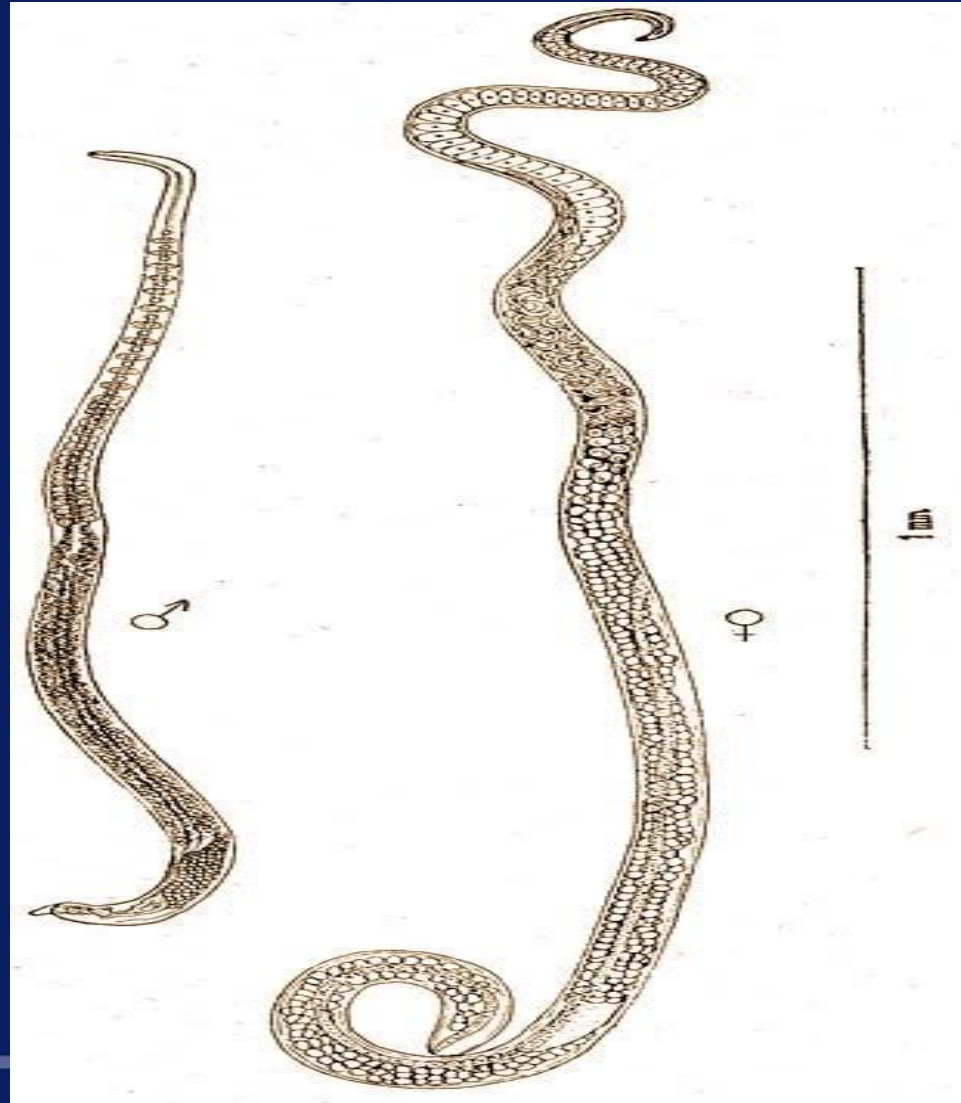
- Trichinellosis infection is caused by eating raw or undercooked meat of animals infected with the encysted larvae of a *Trichinella* worm
 - When a human or animal eats meat containing an infective *Trichinella* cyst, the acid in the stomach or the individual dissolves the hard covering of the cyst and releases the worm
 - The worms then pass into the small intestine and in 1-2 days become mature, at which point the females lay eggs. Eggs develop into mature worms and are transported to muscles (via arteries), where they encyst.
- Infection occurs commonly in wild carnivores but may also occur in domestic pigs



Trichinella spp.



Trichinella spp.



Trichinella spp.

Acute Illness

- Symptoms can include:
 - Headache
 - Aching joints
 - Fevers
 - Muscle pain
 - Chills
 - Itchy skin
 - Cough
 - Diarrhea
 - Constipation
 - Eye swelling
- Many people may never be diagnosed since mild or moderate trichinosis is frequently mistaken for the flu or another common illness.



Trichinella spp.

Acute Illness

Additional Symptoms can include:

- Splinter hemorrhages of the fingernails, swelling and muscle pain (caused by larvae moving through tissue)
- Weakness and soreness (may last months after other symptoms have subsided)
- Central nervous system, heart and respiratory problems (in heavily infected individuals)
- Very rarely do severe cases cause death.



Trichinella spp. Acute Illness



Trichinella spp.

Diagnosis

- Muscle biopsy
- EIA for IgG and IgM is very sensitive and specific
- Eosinophilia, skin tests and serologic tests may aid in diagnosis



Trichinella spp.

Treatment

- Prescription drugs
 - Mebendazole
 - Corticosteroids are used for infections with severe symptoms,
- Treatment during the acute stage is essential since drugs can do very little once larvae have become established in the muscle.
 - The decision to treat is based upon symptoms, exposure to raw or undercooked meat, and laboratory test results.



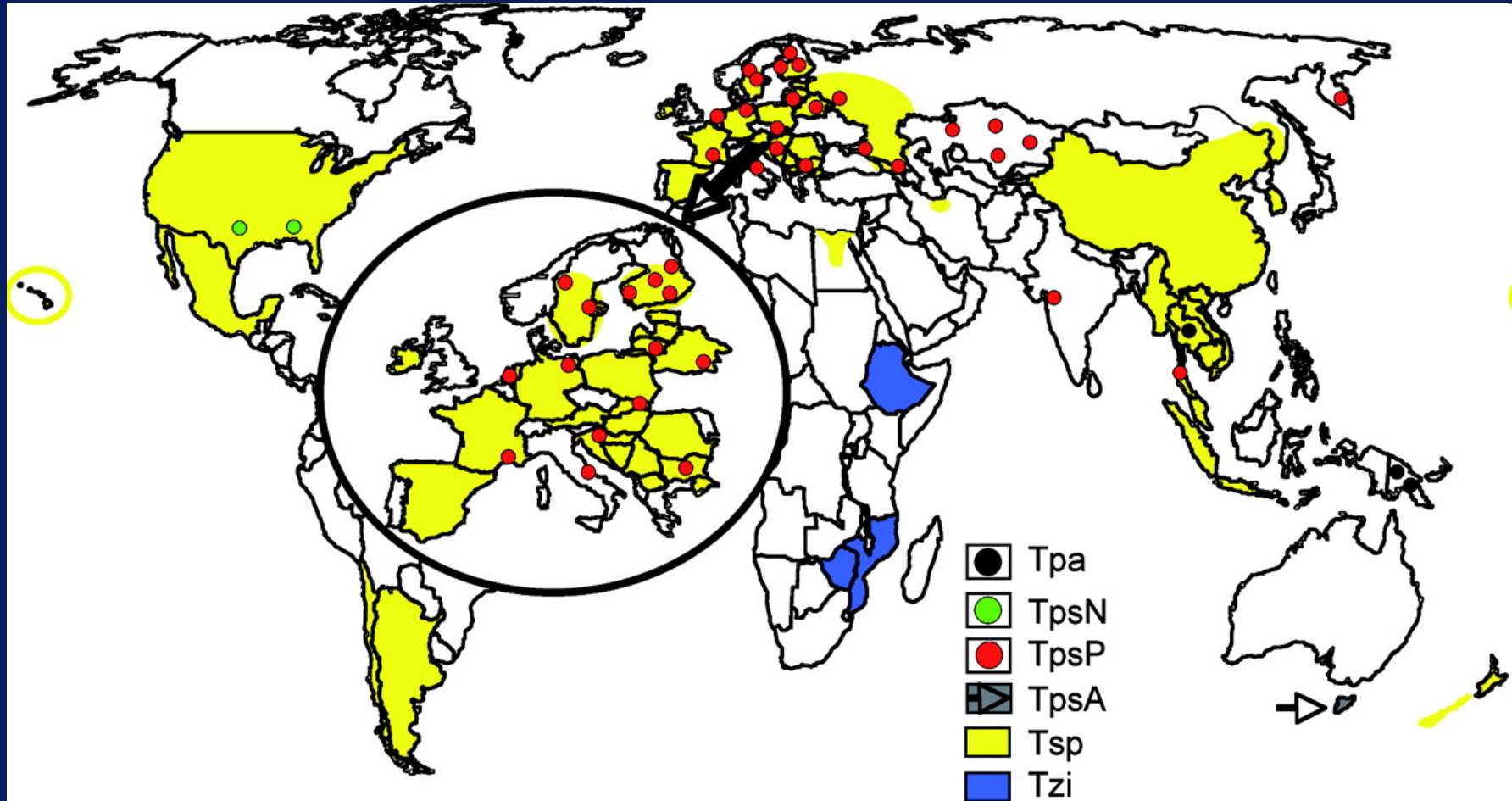
Trichinella spp.

Epidemiology

- Trichinellosis is found worldwide, but it is most common in parts of Europe and the United States.
- Trichinellosis was once widespread throughout the United States, but, due to increased regulations for the meat industry, most cases in the are now limited to people who consume wild game.
- An average of 12 cases per year were reported in the US between 1997 and 2001.
 - However, most infections are never identified.



Trichinella spp. Epidemiology



World map showing the distribution areas of *Trichinella spiralis* (Tsp), *Trichinella pseudospiralis* from North America (TpsN), *T. pseudospiralis* from Europe and Asia (TpsP), *T. pseudospiralis* from Tasmania (TpsA), *Trichinella papuae* (Tpa), and *Trichinella zimbabwensis* (Tzi).



Prevention

- Cook meat, especially pork, bear, walrus, and wild pig thoroughly (to an internal temperature of 76 °C).
 - Salting, drying, smoking or microwaving will not kill the encysted worms.
- Freeze pork less than 6 inches thick for 20 days at -15 °C.
 - Freezing is not very effective for the meat of arctic animals (eg. bears and walrus)
- Cook all meat fed to pigs and other animals and do not allow pigs to eat carcasses of rats.
- Clean all tools used to prepare meat
- Feral pig and wild game hunters should be particularly cautious since *Trichinella* is common among many scavengers and carnivores



Trichinella spp.

Prevention

- Many factors have contributed to the decline in *Trichinella* infection:
 - Better regulation of the meat industry has greatly reduced the incidence of trichinosis in the United States and legislation prohibits feeding uncooked garbage and meat products to pigs.
 - Increased meat inspection has also prevented contaminated pork from entering the marketplace.
 - Public awareness in encouraging people to freeze and cook pork thoroughly.



AMEBIASIS

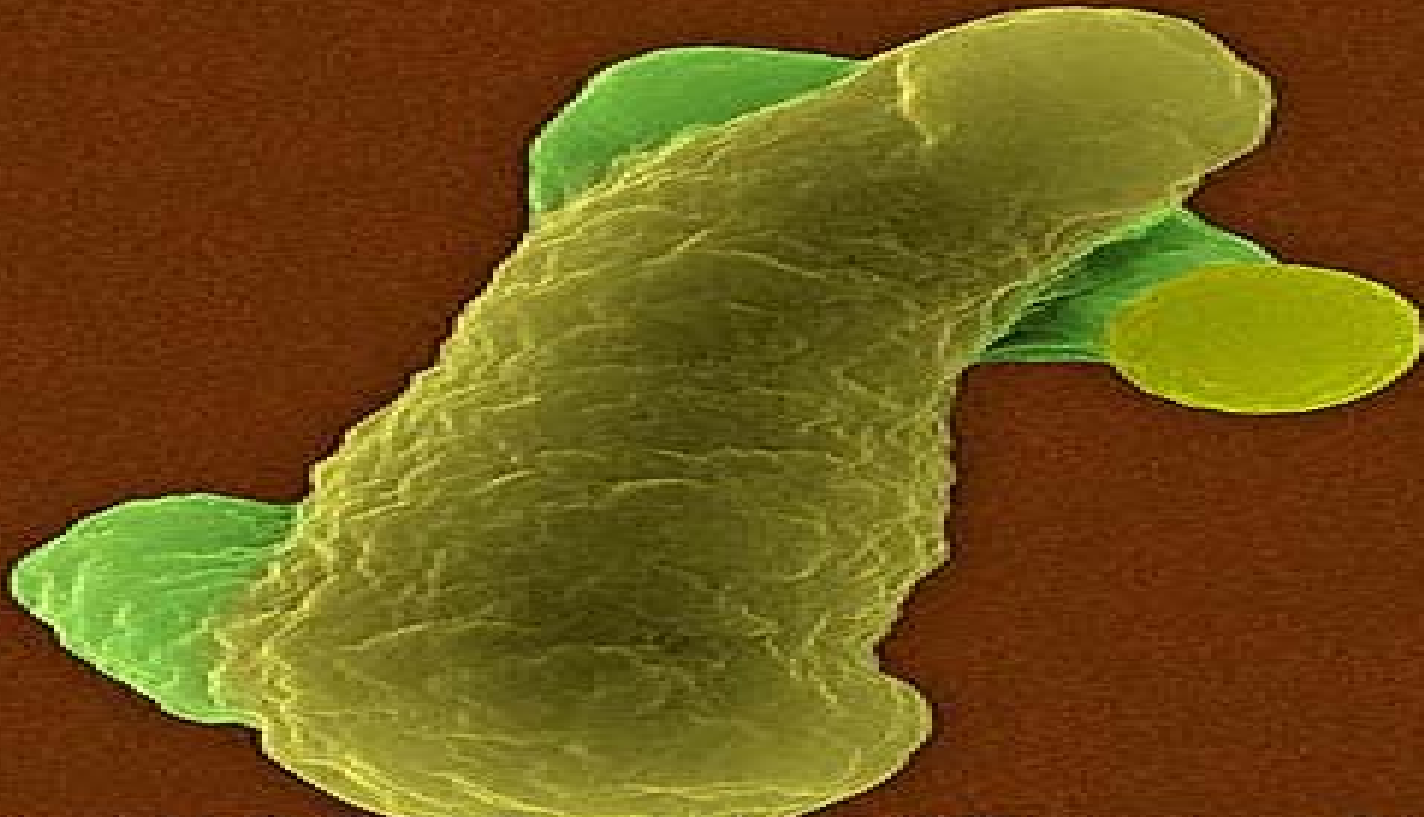


Entamoeba histolytica

- Amebiasis or Amebic dysentery is caused by the pathogenic protozoa, *Entamoeba histolytica*, which can be associated with intestinal and extraintestinal infections.
- Several protozoan species in the genus *Entamoeba* infect humans, but not all of them are associated with disease.
 - The other species are important because they may be confused with *E. histolytica* in diagnostic investigations.



Entamoeba histolytica



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Transmission

- People acquire *E. histolytica* through accidental consumption of mature cysts. This can occur through:
 - Accidental consumption of cysts from fecally contaminated food or water
 - Fruits and vegetables watered with contaminated water are often a source of outbreaks of amebiasis.
 - Touching and bringing to your mouth infective cysts picked up from surfaces contaminated with *E. histolytica*

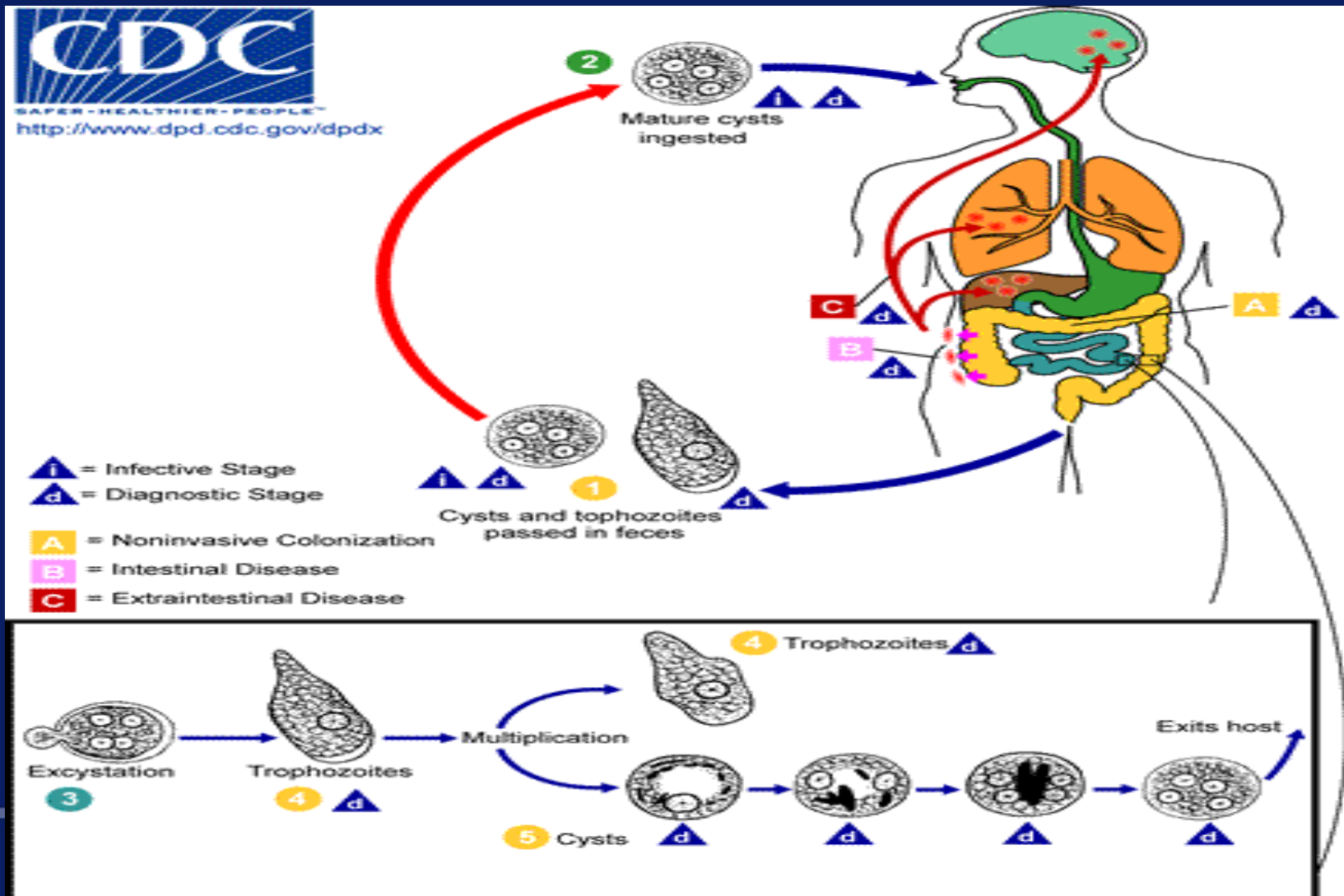


Transmission

- An infected individual sheds both the mature cysts and the trophozoite form of the parasite in their stool.
- Only the mature cyst form is infectious.
 - The trophozoite form are quickly destroyed outside of the body.
- Once a mature cyst is swallowed, trophozoites are released in the small intestine, which migrate to the large intestine and form cysts, which are then shed in stool.



Entamoeba histolytica



Acute Illness

- The infectious dose is unknown, but theoretically, one cyst is capable of causing infection.
- Incubation period: Usually 2-4 weeks after exposure (may be anywhere from a few days to a few months)
- Symptoms can include:
 - Fever
 - Chills
 - Diarrhea
 - can be bloody or contain mucous
 - Cramps
- Only about 10-20% of people infected become sick while many people only have mild abdominal discomfort. Some people carry the parasite for weeks to years, often without symptoms.



Complications

- Rarely, trophozoites may invade the liver, lung or brain or perforate the colon causing septicemia
 - Hepatic amebiasis is the most common complication
 - Cerebral amebiasis is fatal
 - Fulminant amebic colitis has a mortality rate of more than 50%.
 - Pleuropulmonary amebiasis has a mortality rate of 15-20%
 - Amebic pericarditis has a case fatality rate of 40%.



Entamoeba histolytica

Diagnosis

- Microscopic identification of cysts and trophozoites in the stool

This can be accomplished using:

- Fresh stool: wet mounts and permanently stained preparations (e.g., trichrome).
- Concentrates from fresh stool: wet mounts, with or without iodine stain, and permanently stained preparations (e.g., trichrome).
- Serology
 - used for extra-intestinal disease only



Entamoeba histolytica

Diagnosis





- b. Sexual orientation.
- c. History of colonic irrigation, when and where.
- d. Immigration from or travel to a developing country within 6 months prior to onset. Specific dates and places.
- e. Exposure to carrier and other persons with diarrheal illness within incubation period.
- f. Occupation of case and household members.
- g. Residence in facility for the developmentally disabled.
- h. Attendance in day care.

CONTROL OF CASE, CONTACTS & CARRIERS

Contact within 24 hours to determine if sensitive occupation or situation (SOS) involved. Otherwise, investigate within 3 days.

Public Health Nursing Home Visit Protocol:
Home visit as necessary – a face to face interview is conducted as necessary.

Refer to "Public Health Nursing Home Visit AS NECESSARY (HVAN) Algorithm" (B-73 Part IV Public Health Nursing Home Visit Protocol).

CASE:

Precautions: Enteric precautions until clinical recovery.

- 1. **Sensitive Occupation or Situation:** Applies only to food employees, not other SOS. Remove food employees from work until 3 consecutive feces specimens taken 3 or more days apart are negative by O&P. First specimen may be taken after patient is on medication for 5 days. Alternatively, if the *E. histolytica* EIA test is negative, the patient does not have amebiasis and is no longer a case. See Diagnostic Procedures below.

- 2. **Non-sensitive Occupation or Situation:** Release after clinical recovery unless household contacts are food employees.

CONTACTS:

Household members or persons who share a common source.

- 1. **Sensitive Occupation or Situation:**

- a. **Symptomatic:** Treat as a case.
- b. **Asymptomatic:** Clearance not recommended.

- 2. **Non-Sensitive Occupation or Situation:** Clearance not recommended.

CARRIERS:

Refer for treatment. Release as for case.

PREVENTION-EDUCATION

- 1. Stress hand washing and personal hygiene.
- 2. Advise about increased risk with anal and oral-anal sex.
- 3. Dispose of feces in a safe, sanitary fashion.
- 4. Take precautions with food and water when traveling to endemic areas.
- 5. Advise regarding risk associated with colonic irrigation.
- 6. Protect water supply from fecal contamination.

DIAGNOSTIC PROCEDURES

- 1. **Microscopic:**

Container: Feces-Parasite

Laboratory Form: Test Requisition Form H-3021 (Rev. 9/07)

Examination Requested: Ova & Parasites (O&P) for Amebiasis. Check appropriate boxes on laboratory form.

Material: Feces. Follow instructions provided with container.





Amount: Walnut size.

Storage: Do not refrigerate; protect from overheating.

Remarks: Mix thoroughly with PVA preservative. Do not collect specimen(s) for 7-10 days after barium, mineral oil, bismuth, antibiotics, anti-malarials or antidiarrheal preparations such as kaolin have been ingested. Specimen must be unpreserved and examined within 24 hours of passage.

Note: This test does not distinguish between *E. histolytica* and nonpathogenic *E. dispar*. A frozen, unpreserved stool sample can be submitted for *E. histolytica* EIA test to distinguish between the two. Please refer to LA County Public Health Laboratory test catalog for more information.

2. **Serology:** (used for extra-intestinal disease only) To California State Department of Health.

Container: Sterile tube.

Examination Requested: Amebiasis antibody.

Material: Serum.

Amount: 2 ml.

Storage: Refrigerate.

Remarks: Consult with Public Health Laboratory for more information about serology testing. Diagnostic titer: $\geq 1:128$ by IHA test. Allow 2 to 4 weeks for results.



Entamoeba histolytica

Treatment

- Prescription drugs:
 - For asymptomatic infections: iodoquinol, paromomycin, or diloxanide furoate (not commercially available in the U.S.)
 - For symptomatic infections: metronidazole or tinidazole, immediately followed by treatment with iodoquinol, paromomycin, or diloxanide furoate.



Entamoeba histolytica

Epidemiology

- The parasite lives only in humans.
- Amebiasis is the third leading parasitic cause of death worldwide.
- On a global basis, amebiasis affects approximately 50 million people each year and results in nearly 100,000 deaths.
 - Amebiasis is found worldwide, with higher incidence in developing countries and in tropical and subtropical climates.



Entamoeba histolytica

Epidemiology

- The peak incidence is in children less than 14 years old.
- In industrialized countries, risk groups include:
 - Men who have sex with men
 - International travelers
 - Recent immigrants
 - Institutionalized populations



Entamoeba histolytica

Prevention

- Most amebiasis is acquired through fecal contamination of food and water so sanitation and proper hygiene is important in preventing infection.
- Eliminating the use of human feces as fertilizer (night soil)
- Treating water with iodine or boiling



TAENISIS AND CYSTICERCOSIS



Taenia spp.

- The cestodes (tapeworms) *Taenia saginata* (beef tapeworm) and *T. solium* (pork tapeworm) cause an intestinal infection known as taeniasis.
- *Taenia solium* can also cause cysticercosis.



Taenia saginata

- The beef tapeworm, *Taenia saginata*, causes taeniasis in humans through the ingestion of raw or poorly cooked meat of infected cows.
 - These cows have been infected via the ingestion of human feces containing the eggs of the parasite and these cows contain viable cysticercus larvae in the muscle.
- Humans act as the host only to the adult tapeworms in the lumen of the intestine.



Taenia solium

- The pork tapeworm, *Taenia solium*, is capable of causing two distinct infections, depending on the form ingested and the route of infection:
 - Taeniasis: infection with the adult form of the tapeworm
 - Cysticercosis: infection with the larval form of the tapeworm



Taenia solium

Transmission

- Taeniasis: acquired through consumption of raw or undercooked meat of an infected animal.
- Cysticercosis: acquired through consumption of *T. solium* eggs from food or hands contaminated with the feces of an individual infected with the adult form of the tapeworm.

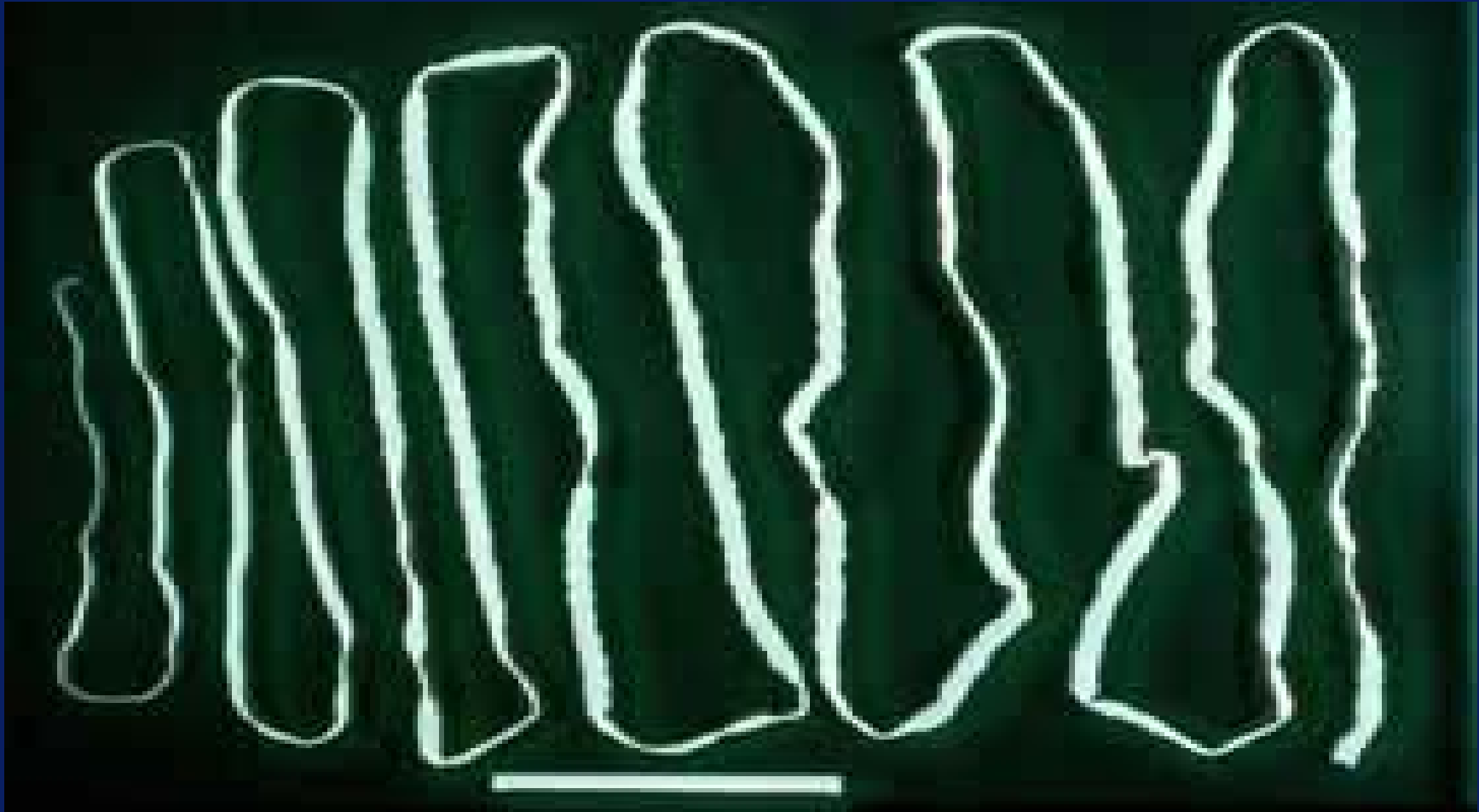


Taenia spp.

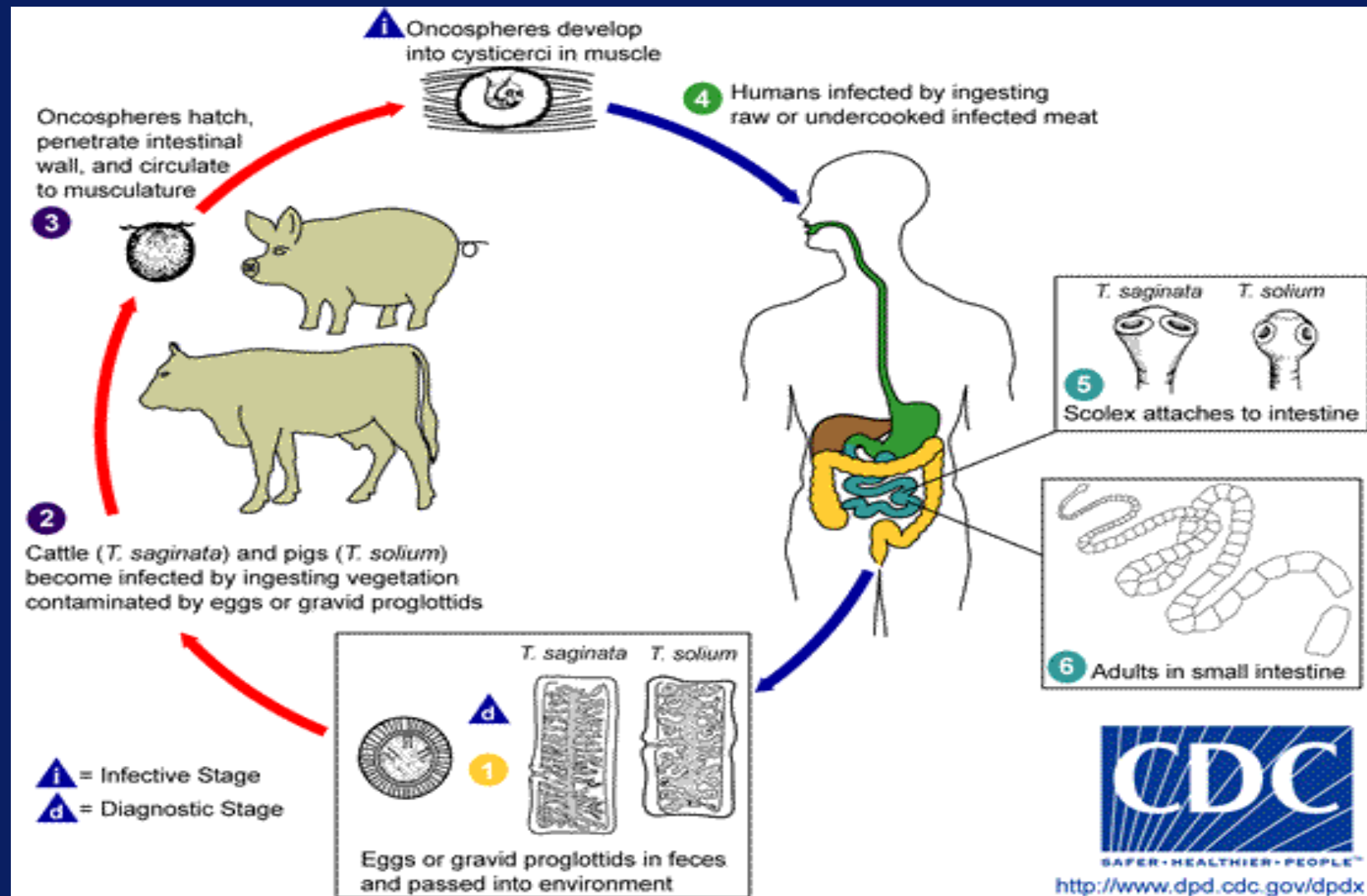
- Autoinfection can also occur via the fecal-oral route once a person is infected with *T. solium* and shedding infectious eggs.
 - Eggs or gravid proglottids re-enter the body through the mouth and often travel to the central nervous system (CNS), the muscles or the eye, where they develop into cysticerci.
 - The presence of cysticerci in these locations leads to the pathogenesis of cysticercosis.



Taenia spp.



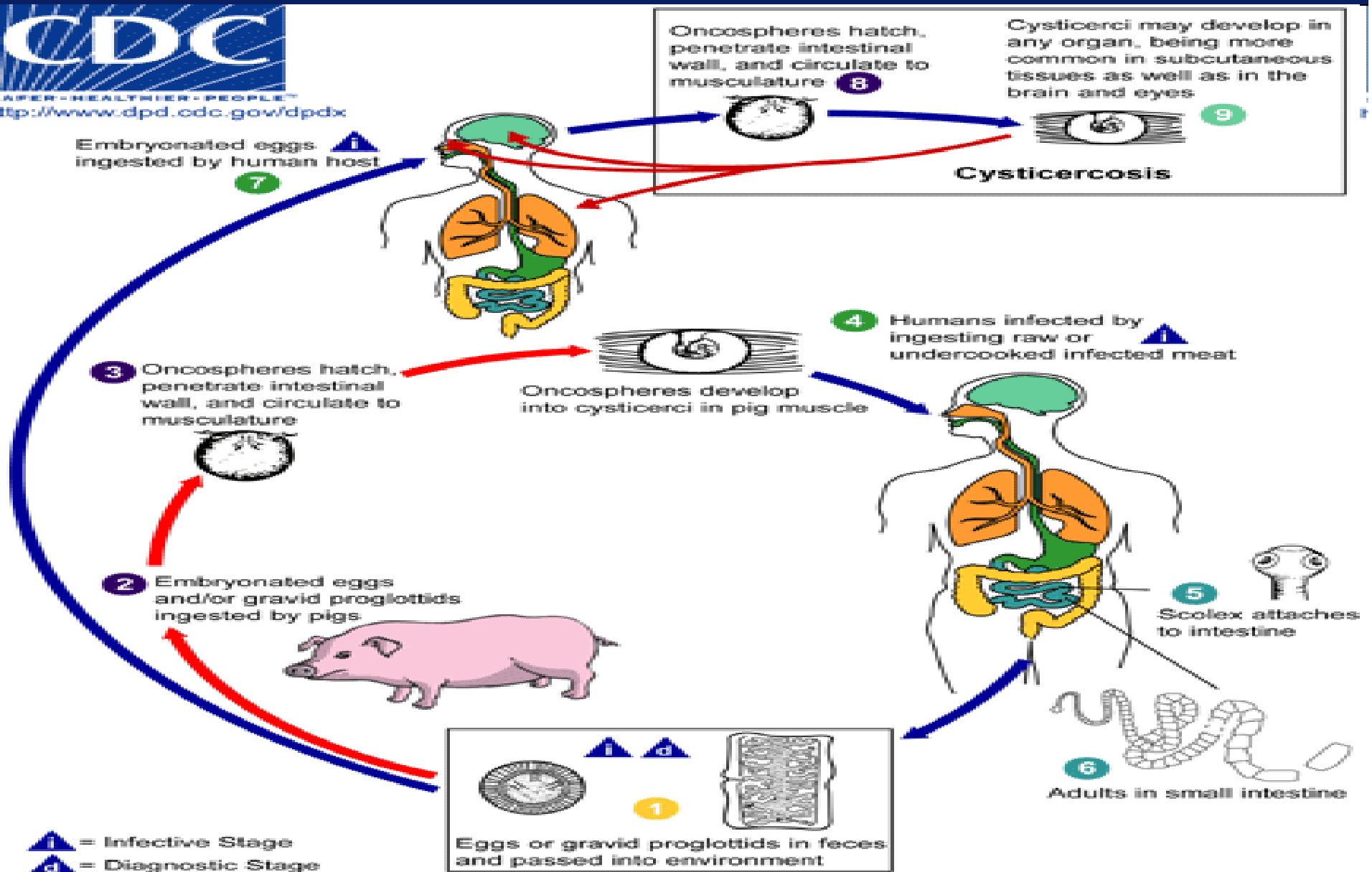
Taenia spp.



Taenia spp.



Taenia spp.



Taenia spp.

Acute Illness

- *Taenia* spp. infection can progress to the disease state as rapidly as 10 days or as slowly as 10 years.
- Although most intestinal infections with taeniasis are asymptomatic, some patients might exhibit the following mild symptoms and/or signs:
 - Abdominal pain
 - Anorexia
 - Weight loss
 - Malaise



Taenia spp.

Taeniasis

- Taeniasis has some common complications including:
 - Appendicitis
 - Obstruction of bile ducts/pancreatic ducts,
 - Ectopic tapeworm growth
 - Mild eosinophilia



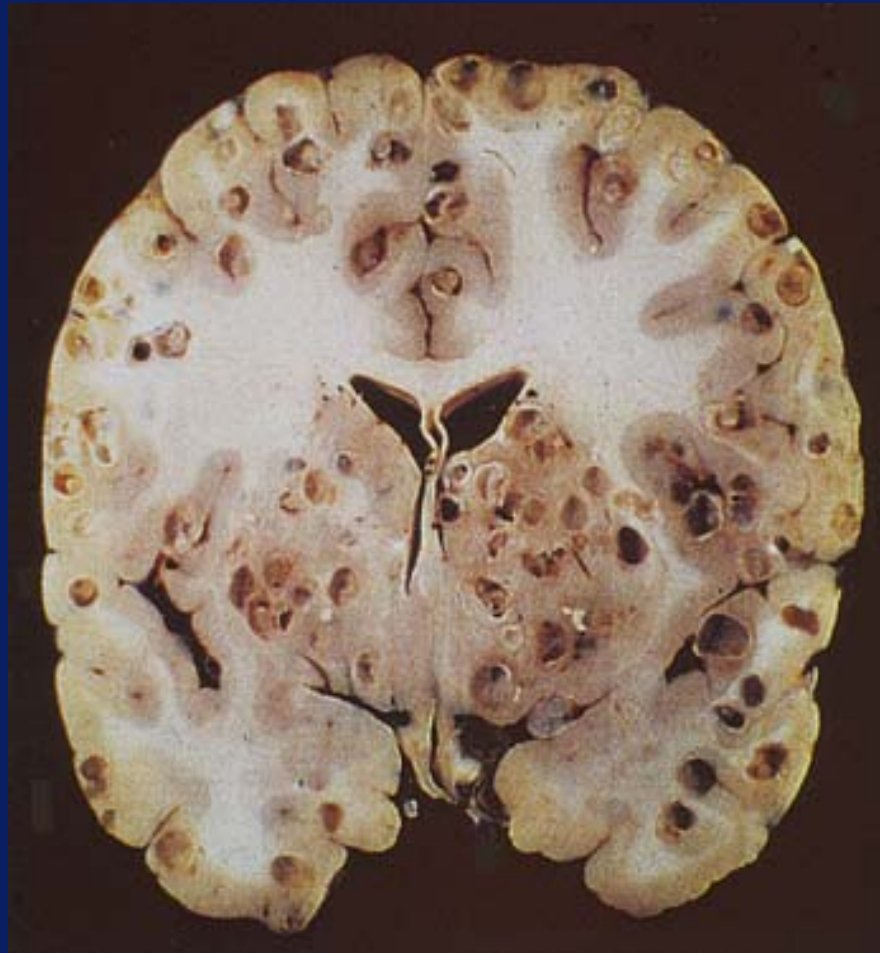
Taenia spp.

Cysticercosis

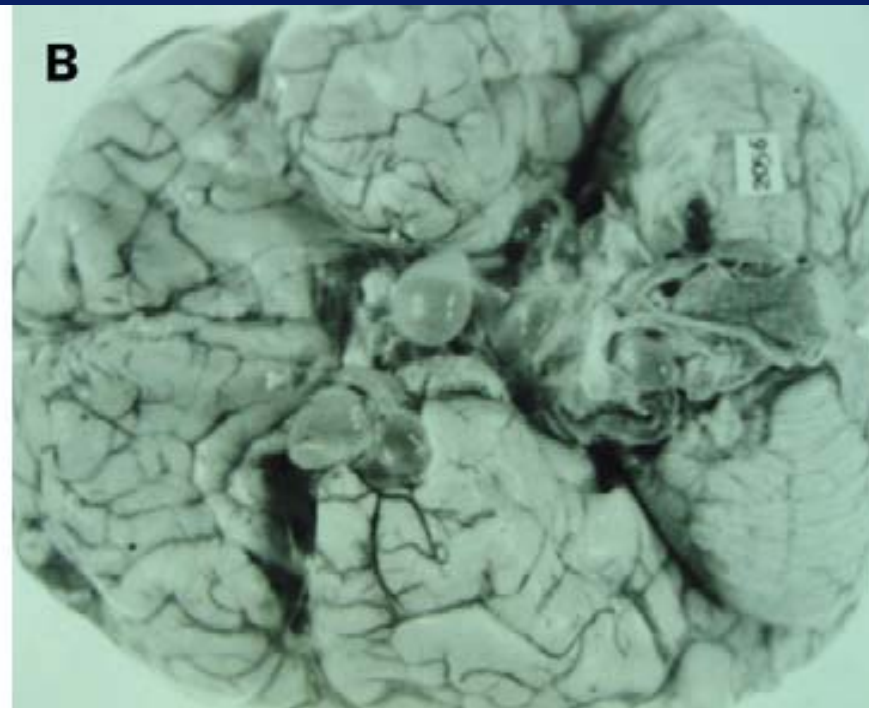
- The most common localizations are of cysticerci in humans are subcutaneous tissue, the eye, and the brain.
- Cysticerci in the brain, known as neurocysticercosis, is the most serious complication.
- There are three classic symptoms for neurocysticercosis:
 - Convulsions and/or seizures
 - Intracranial hypertension
 - Psychiatric disturbances



Taenia spp. Complications



Taenia spp. Complications



Taenia spp.

Diagnosis

- Taeniasis: Microscopic identification of eggs and proglottids in feces
 - Not possible prior to development of adult tapeworms (first 3 months of infection)
 - Repeated examination and concentration techniques will increase the likelihood of detecting light infections.
 - Speciation of *Taenia* is impossible if solely based on microscopic examination of eggs, because all *Taenia* species produce eggs that are morphologically identical.
- OUR NEW TEST
- Cysticercosis: Biopsy, MRI or serologic testing



Taenia spp. Diagnosis



Taenia spp.

Treatment

- Taeniasis:
 - Prescription drugs: Praziquantel and Niclosamide
- Cysticercosis is more complex.
 - Surgery is sometimes necessary to treat infection in the eyes, cases that are not responsive to drug treatment, or to reduce brain edema.
 - Steroids are often used to reduce the swelling due to the inflammatory response to the cysticerci.
 - Not all cases of cysticercosis are treated and the use of albendazole and praziquantel is controversial.



Taenia spp.

Epidemiology

- There are three different ways in which the *Taenia* spp. can be transmitted:
 - Consumption of raw and/or undercooked pork or beef products
 - Human-to-human transfer of *Taenia* spp. eggs through direct contact with feces
 - Human-to-human transfer of *Taenia* spp. eggs through consumption of food/water containing fecal matter (indirect)
- Additionally, humans can acquire cysticercosis via autoinfection.



Taenia spp.

Epidemiology

- Both species are worldwide in distribution.
- It is associated with areas of poor sanitation and high consumption of beef.
- Also associated with areas where humans live in close contact with pigs and cows.
- Many of the cases seen in the United States are from immigrants who came from a country that has higher rates of beef tapeworm.



Taenia spp.

Epidemiology

- The geographic regions with the highest concentration of endemicity are Central South America and Africa.
- Only approximately 1000 cases occur per year in the United States, with the vast majority of cases seen in the Latin American immigrant population.
- For this reason, the incidence of *T. solium* is highest in major urban centers (with large immigrant populations) - namely Chicago, Los Angeles, and New York City.



Taenia spp.

Prevention

- The following measures are recommended for the prevention of taeniasis or cysticercosis:
 - All beef and pork should be inspected for cysticerci, even though inspection procedures don't always detect infection.
 - All meat should be cooked thoroughly to more than 56 °C.
 - Cattle and pork should also not be allowed to graze on polluted vegetation or vegetation exposed to human sewage.

