TRICHINELLOSIS
(Trichiniasis, Trichinosis)

REPORTING INFORMATION
- **Class B:** Report by the close of the next business day after the case or suspected case presents and/or a positive laboratory result to the local public health department where the patient resides. If patient residence is unknown, report to the local public health department in which the reporting health care provider or laboratory is located.
- Reporting Form(s) and/or Mechanism:
    - The Ohio Disease Reporting System (ODRS) should be used to report lab findings to the Ohio Department of Health (ODH). For health care providers without access to ODRS, you may use the Ohio Confidential Reportable Disease form (HEA 3334).
    - The Centers for Disease Control and Prevention (CDC) Trichinosis Surveillance Case Report (CDC 54.7) is required. Information collected from the form should be entered into ODRS **and** faxed to the ODH Bureau of Infectious Diseases at 614-564-2456. The mailing address for this form is: ODH Bureau of Infectious Diseases, 246 N. High St., Columbus, OH 43215.
- Key fields for ODRS reporting include: import status (whether the infection was travel-associated or Ohio-acquired), date of illness onset, and all the fields in the Epidemiology module.

AGENT
Larvae of *Trichinella spiralis*, a small filiform nematode.

CASE DEFINITION
Clinical Description
A disease caused by ingestion of *Trichinella* larvae, usually through consumption of *Trichinella*-containing meat—or food contaminated with such meat—that has been inadequately cooked prior to consumption. The disease has variable clinical manifestations. Common signs and symptoms among symptomatic persons include eosinophilia, fever, myalgia, and periorbital edema.

Laboratory Criteria for Diagnosis
Human Specimens
- Demonstration of *Trichinella* larvae in tissue obtained by biopsy, **OR**
- Positive serologic test for *Trichinella*

Food Specimens
- Demonstration of *Trichinella* larvae in the food item (probable)

Epidemiologic Linkage
Persons who shared the implicated meat/meal should be investigated and considered for case status as described below.

Criteria to Distinguish a New Case from an Existing Case
Serial or subsequent cases of trichinellosis experienced by one individual should only be counted if there is an additional epidemiologically compatible exposure. Because the duration of antibodies to *Trichinella* spp. is not known, mere presence of antibodies without a clinically-compatible illness AND an epidemiologically compatible exposure may not indicate a new infection especially among persons with frequent consumption of wild game that is known to harbor the parasite.

Case Classification

Suspected: Instances where there is no clinically compatible illness should be reported as suspected if the person shared an epidemiologically implicated meal, or ate an epidemiologically implicated meat product, and has a positive serologic test for trichinellosis (and no known prior history of *Trichinella* infection).

Probable:

- A clinically compatible illness in a person who shared an epidemiologically implicated meal or ate an epidemiologically implicated meat product, **OR**
- A clinically compatible illness in a person who consumed a meat product in which the parasite was demonstrated.

Confirmed: A clinically compatible illness that is laboratory confirmed in the patient.

Comments

Epidemiologically implicated meals or meat products are defined as a meal or meat product that was consumed by a person who subsequently developed a clinically compatible illness that was laboratory confirmed.

Negative serologic results may not accurately reflect disease status if blood was drawn less than 3-4 weeks from symptom onset.

SIGNS AND SYMPTOMS

Many infections are asymptomatic. Symptomatic cases result from the ingestion of a large number of larvae. Three phases are recognized: intestinal, larval migration and convalescence.

Intestinal: nonspecific gastroenteritis, with anorexia, nausea, vomiting, abdominal pain and diarrhea.

Larval Migration: occurs 7-11 days after ingestion. Signs of muscular invasion begin, with edema of the upper eyelids, myalgia, headache, fever, sweating, chills, weakness and marked eosinophilia. Usually lasts 10-30 days.

Convalescence: involves muscular pain, which sometimes persists for several months.

DIAGNOSIS

The most specific diagnostic test is a muscle biopsy of the deltoid, biceps or gastrocnemius muscle. Contact the ODH Bureau of Infectious Diseases Outbreak Response and Bioterrorism Investigation Team at 614-995-5599 to arrange for specimen submission.

EPIDEMIOLOGY

Source

Many domestic and wild animal species harbor the parasite. Swine are the primary source of infection in humans and human infection is usually the result of eating inadequately cooked pork or wild game, especially bear meat.

Occurrence

Worldwide, but is most common in areas where raw or undercooked pork or wild game meat are eaten. From 2011-2015, 80 cases were reported in the U.S.

Mode of Transmission
Humans are infected from eating raw or undercooked meat from infected animals, primarily pork products.

Period of Communicability
Trichinosis is not transmitted by person-to-person contact. Animals remain infective for months. Meat from infected animals remains infective for considerable periods unless it is properly cooked, frozen or irradiated.

Incubation Period
Incubation period is usually 8-15 days, with a range of 5-45 days, and seems to be related to the number of larvae ingested.

PUBLIC HEALTH MANAGEMENT

Case

Investigation
Investigation is directed toward determining the source of uncooked meat and identifying other exposed persons.

Treatment
Medications are available that are safe and effective, such as mebendazole, with albendazole as an alternative is used for treatment. Steroids are sometimes used for infections with severe symptoms.

Isolation and Follow-up Specimens
None

Contacts
Trichinosis is not passed from person-to-person.

Prevention and Control
The best way to prevent trichinellosis is to cook meat to safe temperatures. A **food thermometer** should be used to measure the internal temperature of cooked meat. Do not sample meat until it is cooked. USDA recommends the following for meat preparation:

- **For Whole Cuts of Meat (excluding poultry and wild game)**
  - Cook to at least 145°F (63°C) as measured with a food thermometer placed in the thickest part of the meat, then allow the meat to rest* for three minutes before carving or consuming.
- **For Ground Meat (including wild game, excluding poultry)**
  - Cook to at least 160°F (71°C); ground meats do not require a rest* time.
- **For All Wild Game (whole cuts and ground)**
  - Cook to at least 160°F (71°C).
- **For All Poultry (whole cuts and ground)**
  - Cook to at least 165°F (74°C), and for whole poultry allow the meat to rest* for three minutes before carving or consuming.

*According to USDA, "A 'rest time' is the amount of time the product remains at the final temperature, after it has been removed from a grill, oven, or other heat source. During the three minutes after meat is removed from the heat source, its temperature remains constant or continues to rise, which destroys pathogens."

Freezing may not kill all worms in the case of game meats.

REFERENCE

CDC trichinellosis information: http://www.cdc.gov/parasites/trichinellosis/index.html

What is trichinellosis?
Trichinellosis, also called trichinosis, is caused by eating raw or undercooked meat of animals infected with the larvae of a species of worm called *Trichinella*. Infection occurs commonly in certain wild carnivorous (meat-eating) animals such as bear or cougar, or omnivorous (meat and plant-eating) animals such as domestic pigs or wild boar.

What are the signs and symptoms of a trichinellosis infection?
The signs, symptoms, severity and duration of trichinellosis vary. Nausea, diarrhea, vomiting, fatigue, fever, and abdominal discomfort are often the first symptoms of trichinellosis. Headaches, fevers, chills, cough, swelling of the face and eyes, aching joints and muscle pains, itchy skin, diarrhea, or constipation may follow the first symptoms. If the infection is heavy, patients may experience difficulty coordinating movements, and have heart and breathing problems. In severe cases, death can occur.

For mild to moderate infections, most symptoms subside within a few months. Fatigue, weakness, muscle pain, and diarrhea may last for months.

How soon after infection will symptoms appear?
Abdominal symptoms can occur 1-2 days after infection. Further symptoms usually start 2-8 weeks after eating contaminated meat. Symptoms may range from very mild to severe and relate to the number of infectious worms consumed in meat. Often, mild cases of trichinellosis are never specifically diagnosed and are assumed to be the flu or other common illnesses.

How does infection occur in humans and animals?
When a human or animal eats meat that contains infective *Trichinella* cysts, the acid in the stomach dissolves the hard covering of the cyst and releases the worms. The worms pass into the small intestine and, in 1-2 days, become mature. After mating, adult females lay eggs. Eggs develop into immature worms, travel through the arteries, and are transported to muscles. Within the muscles, the worms curl into a ball and encyst (become enclosed in a capsule). The life cycle repeats when meat containing these encysted worms is consumed by another human or animal.

Am I at risk for trichinellosis?
If you eat raw or undercooked meats, particularly bear, pork, wild feline (such as a cougar), fox, dog, wolf, horse, seal, or walrus, you are at risk for trichinellosis.

Can I spread trichinellosis to others?
No. Infection can only occur by eating raw or undercooked meat containing *Trichinella* worms.

What should I do if I think I have trichinellosis?
See your health care provider who can order tests and treat symptoms of trichinellosis infection. If you have eaten raw or undercooked meat, you should tell your health care provider.

How is trichinellosis infection diagnosed?
A blood test or muscle biopsy can show if you have trichinellosis.

How is trichinellosis infection treated?
Several safe and effective prescription drugs are available to treat trichinellosis. Treatment should begin as soon as possible and the decision to treat is based upon symptoms, exposure to raw or undercooked meat, and laboratory test results.

Is trichinellosis common in the United States?
Infection used to be more common and was usually caused by ingestion of undercooked pork. However, infection is now relatively rare. During 2008–2012, 15 cases were reported per year on average. The number of cases decreased beginning in the mid-20th century because of legislation prohibiting the feeding of raw-meat garbage to hogs, commercial and home freezing of pork, and the public awareness of the danger of eating raw or undercooked pork products. Cases are less commonly associated with pork products and more often associated with eating raw or undercooked wild game meats.

Between 2000 and 2017, Ohio reported six cases, the most recent was in 2016.

How can I prevent trichinellosis?
- The best way to prevent trichinellosis is to cook meat to safe temperatures. A food thermometer should be used to measure the internal temperature of cooked meat. Do not sample meat until it is cooked. USDA recommends the following for meat preparation.

    - **For Whole Cuts of Meat (excluding poultry and wild game)**
        - Cook to at least 145°F (63°C) as measured with a food thermometer placed in the thickest part of the meat, then allow the meat to rest* for three minutes before carving or consuming.
    - **For Ground Meat (including wild game, excluding poultry)**
        - Cook to at least 160°F (71°C); ground meats do not require a rest* time.
    - **For All Wild Game (whole cuts and ground)**
        - Cook to at least 160°F (71°C).
    - **For All Poultry (whole cuts and ground)**
        - Cook to at least 165°F (74°C), and for whole poultry allow the meat to rest* for three minutes before carving or consuming.

    *According to USDA, "A 'rest time' is the amount of time the product remains at the final temperature, after it has been removed from a grill, oven, or other heat source. During the three minutes after meat is removed from the heat source, its temperature remains constant or continues to rise, which destroys pathogens."

    - Curing (salting), drying, smoking, or microwaving meat alone does not consistently kill infective worms; homemade jerky and sausage were the cause of many cases of trichinellosis reported in recent years.
    - Freeze pork less than 6 inches thick for 20 days at 5°F (-15°C) to kill any worms.
    - Freezing wild game meats, unlike freezing pork products, may not effectively kill all worms because some worm species that infect wild game animals are freeze-resistant.
    - Clean meat grinders thoroughly after each use.

To help prevent *Trichinella* infection in animal populations, do not allow pigs or wild animals to eat uncooked meat, scraps, or carcasses of any animals, including rats, which may be infected with *Trichinella*.

For more information, see: https://www.cdc.gov/parasites/trichinellosis/