

Trichinella nelsoni, zimbabwei and papuae (Infection with)

Aetiology Epidemiology Diagnosis Prevention and Control
Potential Impacts of Disease Agent Beyond Clinical Illness References

AETIOLOGY

Classification of the causative agent

Trichinella spp. are nematode parasites whose larval stage infects the muscle tissue of their hosts. There are nine named species: *T. spiralis*, *T. nativa*, *T. britovi*, *T. nelsoni*, *T. pseudospiralis*, *T. patagoniensis*, *T. papuae*, *T. zimbabwensis*, *T. murrelli*, and three unnamed species (T6, T8, and T9). The named species are of primary concern for transmission among wildlife species. These species infect several different domestic and wildlife species, including swine, cattle, horses, reptiles, ursids, and marine mammals. Humans can become infected with *Trichinella* spp. after consuming infected meat. Regarding the nine named species, six are encapsulated (*T. britovi*, *murrelli*, *nativa*, *nelsoni*, *patagoniensis*, and *spiralis*) and three are unencapsulated (*T. papuae*, *pseudospiralis*, and *zimbabwensis*). Encapsulated species form a cyst in the muscle, while unencapsulated species do not.

For the purpose of voluntary reporting on non OIE-notifiable disease in wildlife, "*Trichinella* spp. in wildlife" refers to **wildlife** infections. Information on infections of *Trichinella* spp. in **domestic suids and equids** must be submitted through the mandatory reports for the OIE-notifiable diseases.

Resistance to physical and chemical action

Temperature: Larvae may be killed by cooking meat at 71°C for at least one minute, freezing 15 cm-thick pieces at -15°C for three weeks or 50 cm-thick pieces at -15°C for four weeks, and irradiating (0.3 kGy) meat in food packaging

pH: Not well determined.

Chemicals/Disinfectants: 1:1 mixture of xylol and 95% ethanol or phenol kills larval *Trichinella* spp.

Survival: Encapsulated *Trichinella* spp. larvae have been found to survive up to 4 months in rotten meat; nonencapsulated *Trichinella* spp. have been found to survive up to nine days in pig tissue at 35°C. Some species (e.g. *T. nativa* and *T. britovi*) are very resistant to freezing.

EPIDEMIOLOGY

Hosts

Trichinella spp. can infect a wide range of animal hosts. This is not an exhaustive list.

- *T. britovi*
 - Brown bear (*Ursus arctos*)
 - Golden jackal (*Canis aureus*)
 - Raccoon (*Procyon lotor*)
 - Red fox (*Vulpes vulpes*)
- *T. murrelli*
 - Black bear (*Ursus americanus*)
 - Coyote (*Canis latrans*)
 - Raccoon (*Procyon lotor*)
- *T. nativa*
 - Arctic fox (*Vulpes lagopus*)
 - Bearded seal (*Erignathus barbatus*)
 - Polar bear (*Ursus maritimus*)

- Red fox (*Vulpes vulpes*)
- Ringed seal (*Phoca hispida*)
- Walrus (*Odobenus rosmarus*)
- Wolf (*Canis lupus*)
- *T. nelsoni*
 - Bushpig (*Potamochoerus porcus*)
 - Lions (*Panthera leo*)
 - Spotted hyena (*Crocuta crocuta*)
 - Warthog (*Phacochoerus aethiopicus*)
- *T. papuae*
 - Saltwater crocodiles (*Crocodylus porosus*)
 - Wild boar (*Sus scrofa*)
- *T. patagoniensis*
 - Cougar (*Puma concolor*)
- *T. pseudospiralis*
 - Black vulture (*Coragypus atratus*)
 - Brown rat (*Rattus norvegicus*)
 - Wild boar (*Sus scrofa*)
- *T. spiralis*
 - Deer mice (*Peromyscus maniculatus*)
 - Norwegian rat (*Rattus norvegicus*)
 - Wild boar (*Sus scrofa*)
 - Wild horses (*Equus ferus*)
- *T. zimbabwensis*
 - Nile crocodile (*Crocodylus niloticus*)
 - Nile monitor lizard (*Varanus niloticus*)

Transmission

- Consumption of infectious tissue
- Consumption of faeces from animals who have recently eaten tissue infected with *Trichinella* spp. larvae

Sources

- Infected carcasses
- Faeces

Occurrence

Members of *Trichinella* have a worldwide distribution, excluding Antarctica. There are two cycles that describe the persistence of *Trichinella* spp. in hosts: one is the domestic cycle, dominated by *T. spiralis* and maintained by domestic swine, and the other is the sylvatic cycle, which is maintained in wildlife species. Sylvatic cycles involve transmission between wildlife and domestic animals, and are mostly maintained by rodents.

Trichinella spp. have distinct geographic distributions. *T. spiralis* and *T. pseudospiralis* are found throughout the world; *T. spiralis* is found wherever there is domestic swine. *T. murrelli* is found in temperate climates of the United States, such as the Atlantic coastline. *T. nelsoni* and *T. zimbabwensis* are found in sub-Saharan Africa. *T. papuae* has been found in Papua New Guinea. *T. britovi* is found in Europe and Russia, and *T. nativa* is distributed in arctic and subarctic regions such as Siberia, East Europe, and Alaska. In 2012, the most recently classified species *T. patagoniensis* was identified in Argentina and has not yet been detected elsewhere.

Hunters can contribute to the spread of *Trichinella* by leaving infected carnivore carcasses for bait. Polar bears are the main source of spread for *T. nativa* in the Arctic; rodents have a tendency to spread *T. spiralis* worldwide.

DIAGNOSIS

After a host consumes infected meat, larvae travel to epithelial cells of the small intestine, where they moult and develop into an immature adult worm. The adult worms mate in epithelial tissue, and eggs are laid four to seven days after initial infection. Larvae travel throughout the body via peripheral circulation to infect skeletal muscle. It takes approximately three weeks for the larvae to form a cyst in muscle for encapsulated *Trichinella* spp., and one to two more months for the larvae to become infective. The larvae are able to persist in nurse cells of animal tissue under anaerobic conditions. *Trichinella* larvae are generally found in diaphragm, masseter, and tongue muscles.

Clinical diagnosis

Clinical signs of infection are generally not observed, except during instances of high parasite burden. In these cases, signs include diarrhoea, catarrhal enteritis, fever, eosinophilia, myocarditis, and acute myositis

Lesions

- In muscle tissue, *Trichinella* spp. are indistinguishable from each other
- Encapsulating species generally localise in the tongue, diaphragm, and leg muscles
- Nonencapsulating species tend to localise in the diaphragm
- Larvae are 800-1000 µm in length
- Transparent, lemon-shaped cysts, 0.3-0.8 by 0.2-0.4 mm
- Myofiber necrosis and leukocyte and eosinophilic infiltration may occur in affected cells and larval migration tracks
- In encapsulated species, nurse cells (modified skeletal muscle cells) have multiple nuclei in which coiled, intra-sarcoplasmic larvae reside
- In nonencapsulated species, nurse cells containing the larvae form without a capsule and are associated with diffuse, intramyofibrillar degeneration

Differential diagnoses

- Salmonellosis
- *Campylobacter jejuni*
- *Escherichia coli*
- Other helminths
 - Cysticercosis (*Taenia solium*, *Taenia saginata*)
- Protozoa
 - Apicomplexans such as coccidia
 - *Trichomonas*
 - *Giardia*
- Toxin exposure
 - Ionophores
 - Herbicides
 - Rodenticides

Laboratory diagnosis

Samples

For isolation of agent

- Striated muscle

- Diaphragm
- Intercostals
- Tongue
- Masseter
- Small intestine

Serological tests

- Serum
- Whole blood

Procedures

Identification of the agent

- Press striated muscle between two glass slides to observe larvae with a dissecting microscope or trichinoscope
- Adult worms may be observed in the small intestine using a dissecting microscope
- Digest muscle tissue in 1% HCl pepsin at 37°C
 - Filter tissue through metal screen
 - Report number of larvae seen as larvae per gram (larvae/g) muscle tissue
- Polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) for determining *Trichinella* larval species
- Loop-mediated isothermal amplification (LAMP) for *T. spiralis*

Serological tests

- Antibody-capture enzyme-linked immunosorbent assay (ELISA)
- Immunoblotting
- Indirect immunofluorescence test
- Competitive inhibition assay
- Counterimmunoelectrophoresis
- Immunoradiometric assay

PREVENTION AND CONTROL

Sanitary prophylaxis

- Inspect animal carcasses for evidence of *Trichinella* infection before feeding to animals in zoological collections, crocodile farms, sled or hunting dogs, or for use as bait while hunting
- Maintain low rodent populations through the use of rodenticides, baits, and traps as well as destruction of nearby rodent dwellings
- Ensure proper fencing, housing, or enclosures to prevent interaction with wild rodents and boars

Medical prophylaxis

- There is no medical prophylaxis reported for this parasite in animals.

POTENTIAL IMPACTS OF DISEASE AGENT BEYOND CLINICAL ILLNESS

Risks to public health

- *Trichinella* spp. are zoonotic agents; *T. spiralis* from pork consumption is most commonly implicated in human infection
- It is important to thoroughly cook meat to kill infective larvae (meat should have an internal temperature of 63°C for roast, 71°C if ground)

Risks to agriculture

- Several *Trichinella* spp. have the ability to infect livestock. Domestic swine are most commonly found to be infected; it is also possible for goats, horses, and cattle to become infected, resulting in production and economic losses to farmers.
- There is a risk that livestock may become infected with *Trichinella* spp. after grazing on pasture or ingesting feed contaminated by faeces from infected wildlife (e.g., bears, foxes)
- *Trichinella* spp. have been found on crocodile farms in Zimbabwe and Papua New Guinea due to feeding saltwater crocodiles infected meat
 - In Zimbabwe, the cause of *T. zimbabwensis* in farmed crocodiles was due to feeding infected crocodile meat to resident crocodiles
 - In Papua New Guinea, *T. papuae* infection was caused by feeding crocodiles wild pig meat

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The OIE will periodically update the OIE Technical Disease Cards. Please send relevant new references and proposed modifications to the OIE Science Department (scientific.dept@oie.int). Last updated 2020. Written by Samantha Gieger and Erin Furmaga with assistance from the USGS National Wildlife Health Center.