Trichinellosis

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Etiology

Parasitic nematodes of the genus *Trichinella*. Nine species (*T. spiralis*, *T. nativa*, *T. britovi*, *T. murrelli*, *T. nelsoni*, *T. pseudospiralis*, *T. papuae, T. zimbabwensis* and *T. patagoniensis*) and 3 genotypes (T6, T8 and T9) are genetically and biologically delineated into 2 distinct clades characterized by the presence or absence of an intramuscular collagen capsule (Table 1). Four species are currently encountered in European wildlife: *T. spiralis, T. britovi, T. pseudospiralis* and *T. nativa*.

Affected species (wildlife, domestic animals, humans)

Broad spectrum of potentially infected species involving domestic or wild mammals, birds, reptiles and humans, on all continents except Antarctica (no report or investigation carried out so far):

Table 1. Geographical distribution and host range of *Trichinella* species and genotypes (adapted from Gottstein *et al*., 2009).

Species and genotype	Geographical distribution	Typical host range
Encapsulated		
T. spiralis (T1)	Cosmopolitan (including **Europe**)	Domestic and sylvatic swine, carnivores, synanthropic mammals
T. nativa (T2)	Arctic and subarctic **Europe**, Asia, and North America	Sylvatic carnivores
Trichinella T6	Subarctic Canada and USA	Sylvatic carnivores
T. britovi (T3)	Temperate **Europe** and Asia, and North-Western Africa	Sylvatic carnivores and omnivores, pigs
Trichinella T8	South Africa and Namibia	Sylvatic carnivores
T. murelli (T5)	USA and Southern Canada	Sylvatic carnivores
Trichinella T9	Japan	Sylvatic carnivores
T. nelsoni (T7)	Southern Africa	Sylvatic carnivores
T. patagoniensis (T12)	Argentina	Cougars
Nonencapsulated		
T. pseudospiralis (T4)	Sporadically cosmopolitan (including **Europe**)	Sylvatic carnivores, birds of prey, pigs
T. papuae (T10)	Papua New Guinea, Thailand	Wild pigs, saltwater crocodiles
T. zimbabwensis (T11)	Zimbabwe, Mozambique, Ethiopia, South Africa	Nile crocodiles, monitor lizards

Epidemiological characteristics and disease course

The *Trichinella* life cycle is characterized by (1) an intestinal or enteral phase that corresponds to the release of larvae into intestinal mucosa, and (2) a muscular phase (or parenteral or systemic) starting with the migration of larvae into blood vessels and their spread throughout the body until reaching their final niche, i.e, the striated skeletal muscles.

Transmission among animals: Ingestion of infectious muscle from carrion of a homologous or heterologous species. Human infection: Ingestion of raw or inadequately cooked infected meat (mainly pig, wild boar and horse).

Domestic cycle: The focus is on a swine herd being fed, e.g., uncooked pork scraps, carrion, garbage (i.e., garbage-fed pigs), or on pigs allowed to feed on carcasses that are not promptly removed from the farm; synanthropic animals, particularly rodents, living near swine herd can contribute to the domestic cycle. *T. spiralis* and *T. britovi* are the main species involved in domestic cycle in Europe.

Sylvatic cycle: in Europe, transmission of the four present *Trichinella* species occurs mainly between wildlife hosts, mainly foxes, wild boars and wolves. Interaction between sylvatic and domestic cycle can occur when poor husbandry practices do not ensure strict separation between pigs and wildlife.

Clinical signs

In animals: no clinical signs recognized.

In humans: trichinellosis is characterized, during enteral phase, by nausea, diarrhea, vomiting, fatigue, fever and abdominal discomfort; and, during muscular phase, by muscle pains, headaches, fever, facial and eye swelling (edema), aching joints, chills, cough and itchy skin. More severe cases are possible including difficulties with coordinating movements, heart and breathing problems.

Gross lesions

No macroscopic lesions induced by *Trichinella* infection.

Histological lesions

Encapsulated or free larvae in the muscle.

Differential diagnosis

Other migrating nematode larvae recovered by digestion assay and/or leading to flu-like symptoms.

Criteria for diagnosis

Morphological criteria: Muscle larvae recovered by digestion assay are 1 mm long and 30 µm wide, contain stichosomes, and are not morphologically distinguishable to species or genotype.

Molecular identification: Multiplex PCR analysis generates DNA products that are unique in size for each species and genotype of *Trichinella* (Zarlenga et al., 2009).

Recommended diagnostic method(s) and preferred samples (incl. recommended amount and appropriate storage)

Digestion assays are the only recommended procedures for the reliable detection of Trichinella larvae in meat. Different digestion assays are officially recognized in various countries for trade purposes. Assays other than those recommended by the International Commission on Trichinellosis (ICT) (documented standards in the EU, Canada or the USA) are not recommended. Trichinoscopy (examination of tiny pieces of meat by stereomicroscopy) is less sensitive and may be useful for rapid preliminary diagnosis. The EU reference method for the detection of Trichinella larvae in meat is the magnetic stirrer method for pooled sample digestion (protocol in annex I, chapter 1 of the EC regulation 2075/2005; EEC, 2005). Analysis on fresh meat is recommended for human consumption. Freezing muscles prior to the artificial digestion is possible for epidemiological study on wild animals not designated for human consumption. The tongue and diaphragm of animals are main recommended sampling sites for the detection of all species/genotypes of Trichinella (Gajadhar et al., 2009).

TABLE 2. Predilection sites for *Trichinella* larvae in a few wild host species and size of samples to be examined.

Animal species	Predilection sites	Sample weight to be examined
Wild boar (*Sus scrofa)*	Forearm muscles, diaphragm, tongue	5 g
Fox (*Vulpes* spp.*)*	Diaphragm, forearm muscles, tongue	5 g at least
Bear (*Ursus* spp.*)*	Diaphragm, tongue, masseter muscle	10 g

Serology using the excretory/secretory antigens ELISA is recommended by ICT only for

epidemiological surveys.

APHAEA protocol (for harmonization at large scale)

Digestion assays as recommended by the International Commission on Trichinellosis.

Laboratories that can be contacted for diagnostic support

French NRL for Parasites transmitted by food, Anses, France (www.anses.fr/en)

EU Reference Lab for parasites, Istituto Superiore de Sanita, Italy (www.iss.it/crlp/index.php)

Recommended literature

EEC. 2005. Regulation (EC) N° 2075/2005 of the European Parliament and of the Council of 5 December 2005 laying down specific rules on official controls for Trichinella in meat. Official Journal of the European Community L 338: 60-82.

Gottstein, B., E. Pozio, and K. Nöckler. 2009. Epidemiology, diagnosis, treatment, and control of trichinellosis. Clinical microbiology reviews 22: 127-145.

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