

Trichinellosis (Trichinosis)

Extended Version

Classic case:

Pigs: NO clinical signs

Humans: High fever, weakness, arthralgia, **myalgia**, abdominal pain, diarrhea, facial & **periorbital edema**, hives, dizziness, paresis & occasionally death

Presentation: *Trichinella spiralis*

Pigs:

- History of eating
 - Rodents, wildlife carcasses
 - Raw, infected meat
 - Cannibalism, tail biting
- **NO clinical signs-happy pigs**

Humans:

- History of eating undercooked pork, bear, wild boar
- 3 Phases
 - **Intestinal** – abdom. discomfort, cramping, diarrhea
 - **Muscle invasion** (9-10 days post infection)
 - Muscle pain (esp. when breathing, chewing, swallowing or using large muscles),
 - Muscle weakness
 - Inflammation of eyes
 - **Encystment** (2- 8 weeks post infection)
 - **Painful swelling** of arms, legs, abdomen, face
 - Pneumonia
 - Anemia and intermittent fever
 - Eosinophilia



Trichinella spiralis = Happy pigs
NO clinical signs in pigs

Image courtesy Titanium22



Clinical appearance of eyes in a patient with trichinellosis.

Note **periorbital swelling**.

Image courtesy, Dr. Thomas F. Sellers

DDx: Sarcosporidiosis, cysticercosis, tyrosine crystals in muscles

Test(s) of choice: Contact State vet when Dx confirmed

Histopathology:

- Microscopic examination for larvae
 - Tongue
 - Diaphragm

At slaughter:

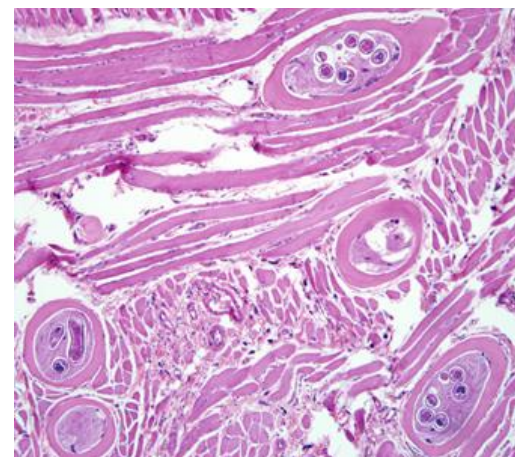
Inspect meat for viable trichinae

- **Trichinoscopic methods**
- **Digestion methods**

ELISA:

Detects anti-*Trichinella* antibodies

- Seroconversion may take weeks post-infection



Trichinella larvae encysted in muscle tissue
200X magnification.

Image courtesy DPDx

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Rx of choice:

Domestic animals: Impractical

Humans: See physician.

- Mebendazole or albendazole can treat intestinal infection
- There is **no specific treatment** for trichinosis once the larvae have invaded the muscles.
- The cysts remain viable for **up to 30 years**
- Pain killers can help relieve muscle soreness.

Prevention: 100% preventable in humans

Prevent ingestion of viable *Trichinella* cysts in muscle

Pigs:

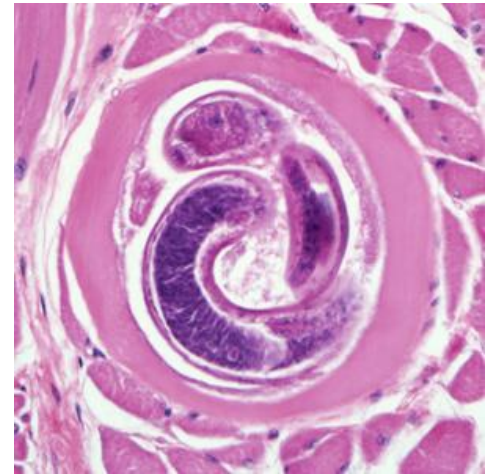
- Good management
- Control rodents
- Cook garbage fed to pigs for 30 min @ 212°F (100°C)
- Prevent cannibalism and access to carcasses
 - Tail biting
 - Wildlife carcasses
 - Dead rats in grain

At slaughter: Inspect meat for viable trichinae

In North America it is assumed that all pork is infected

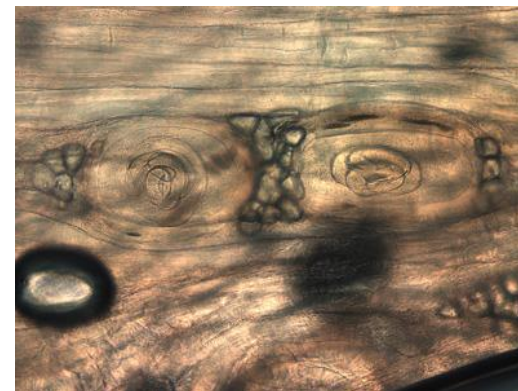
- Adequately processed “ready to eat” products kill trichinae
 - Adequate heating
 - Freezing
 - Curing
- Uncooked products
 - **Adequately cook pork:**
 - Heat meat to internal temp $\geq 137^{\circ}\text{F}$ (58°C)
 - **Freeze pork:**
 - 5°F (-15°C) for 20 days
 - -9.4°F (-23°C) for 10 days OR
 - -22°F (-30°C) for 6 days

DO NOT rely on freezing to kill trichinae in meat other than pork (bear, wild boar, others)



Trichinella larvae in muscle tissue.
400X magnification

Image courtesy DPDx



Spiral-shaped *Trichinella* larvae
(in **bear** meat).

Image courtesy, DPDx

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Pearls:

Trichinella spp.

- Nematode, 8 species, 11 genotypes (T1-T11)
- *T. spiralis*, T1 is MOST COMMON species in temperate climates
- *Trichinella spiralis* encysts in muscle
 - Predilection sites:
 - **Tongue, diaphragm-tissues of choice for histopath**
 - Eye
 - Masticatory muscles
 - Intercostal muscles
 - **Larvae remain viable for years in dead rotting carrion**
 - Development continues **only** if ingested by ano. suitable host
- Most mammals susceptible to infection
 - **High infectivity for pigs & rodents**
 - Humans infected by consumption of **undercooked meat**
 - **Pig (pork products)**
 - Bear
 - Cougar
 - Natural infections also reported in
 - Horses, moose
 - Rats, Cats
 - Beavers, opossums
 - Whales, walruses
 - Meat-eating birds



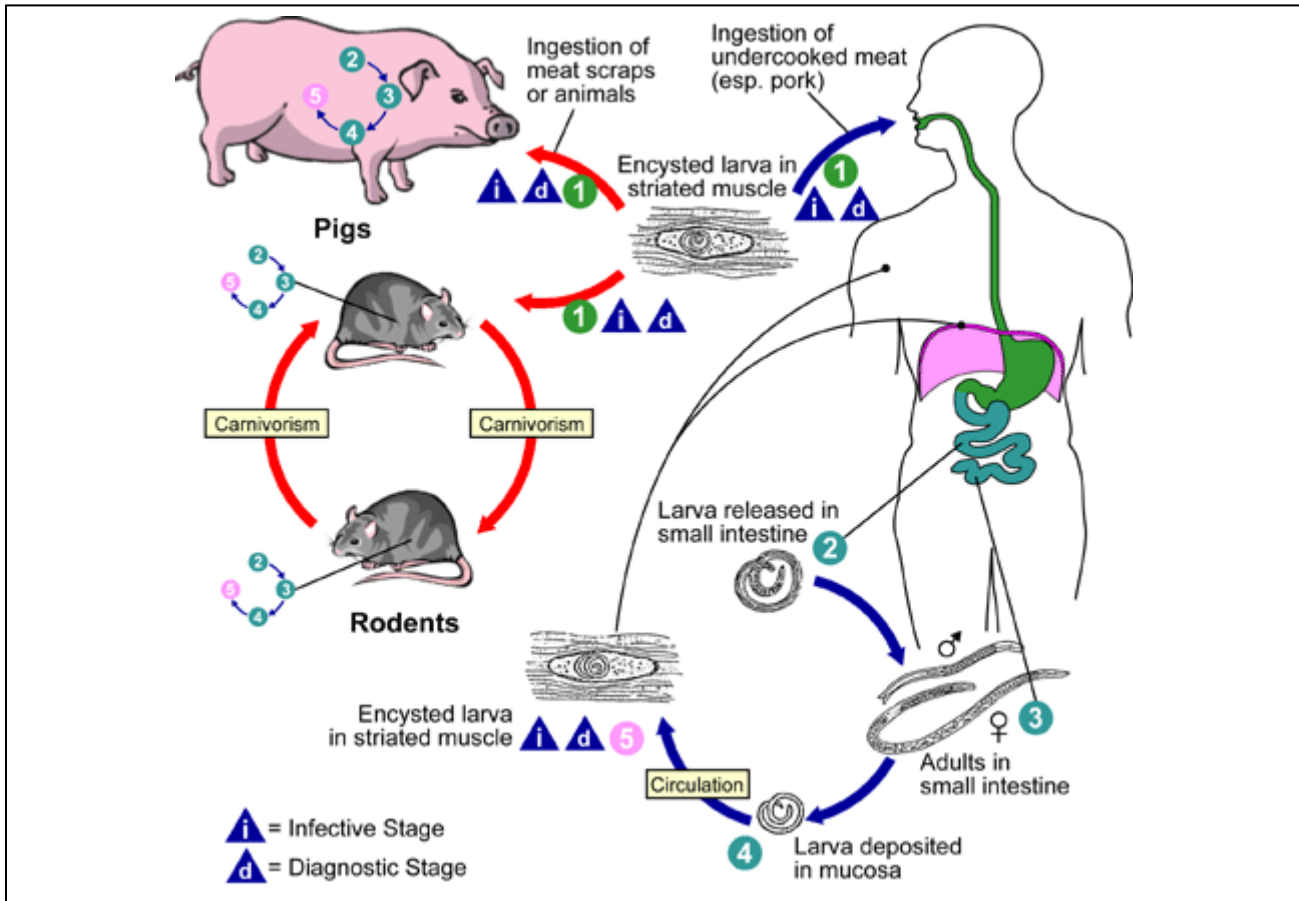
Pork delivery.
Image courtesy,
David Monniaux

Refs: Merck Manual, 10th ed (online): Trichinellosis (Trichinosis); Manual of Meat Inspection for Developing Countries; US Centers for Disease Control and Prevention (CDC), Trichinellosis, Laboratory Identification of Parasites of Public Health Concern. DPDx, Hall et al., *Outbreak of human trichinellosis in Northern California caused by Trichinella murrelli* (from eating undercooked bear meat), Am J Trop Med Hyg. 2012 Aug;87(2):297-302., Gottstein, et al. *Epidemiology, Diagnosis, Treatment, and Control of Trichinellosis*, Clin. Microbiol. Rev. Jan 2009 vol. 22 no. 1 127-145, Montgomery, et al., Trichinellosis Surveillance- United States, 2002—2007, Morbidity and Mortality Weekly Report (MMWR), Dec. 4, 2009 / 58(SS09);1-7

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Domestic *Trichinella* life cycle – The most common way humans are infected



Trichinellosis is acquired by ingesting meat containing cysts (encysted larvae) ① of *Trichinella*.

After exposure to gastric acid and pepsin, the larvae are released ② from the cysts and invade the small bowel mucosa where they develop into adult worms ③ (female 2.2 mm in length, males 1.2 mm; life span in the small bowel: 4 weeks).

After 1 week, the females release larvae ④ that migrate to the striated muscles where they encyst ⑤.

Encystment is completed in 4 to 5 weeks and the encysted larvae may remain viable for several years. Ingestion of the encysted larvae perpetuates the cycle. Rats and rodents are primarily responsible for maintaining the endemicity of this infection.

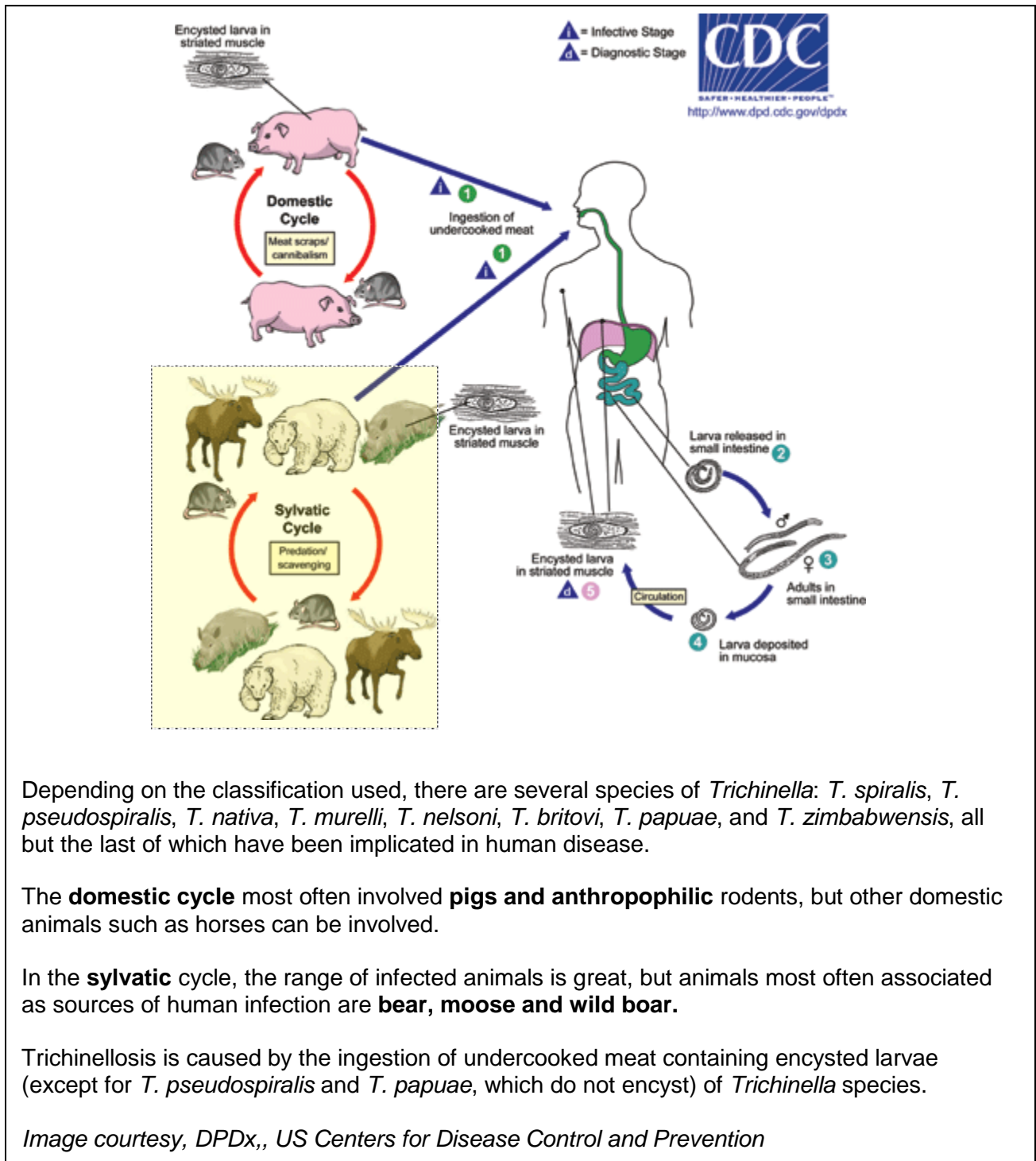
Carnivorous/omnivorous animals, such as pigs or bears, feed on infected rodents or meat from other animals. Different animal hosts are implicated in the life cycle of the different species of *Trichinella*. Humans are accidentally infected when eating improperly processed meat of these carnivorous animals (or eating food contaminated with such meat).

Image courtesy, DPDx,, US Centers for Disease Control and Prevention

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Trichinella also circulates in wildlife (sylvatic cycle-bear, rodents, moose, wild pigs)



Depending on the classification used, there are several species of *Trichinella*: *T. spiralis*, *T. pseudospiralis*, *T. nativa*, *T. murelli*, *T. nelsoni*, *T. britovi*, *T. papuae*, and *T. zimbabwensis*, all but the last of which have been implicated in human disease.

The **domestic cycle** most often involved **pigs and anthropophilic** rodents, but other domestic animals such as horses can be involved.

In the **sylvatic** cycle, the range of infected animals is great, but animals most often associated as sources of human infection are **bear, moose and wild boar**.

Trichinellosis is caused by the ingestion of undercooked meat containing encysted larvae (except for *T. pseudospiralis* and *T. papuae*, which do not encyst) of *Trichinella* species.

Image courtesy, DPDx,, US Centers for Disease Control and Prevention