Review Article

Trichinellosis: the zoonotic importance

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ABSTRACT

Trichinellosis is a parasitic disease of mammals caused by the nematode parasite, Trichinella species. The disease is also called as trichinosis, trichiniasis or trichineliasis. It is an important zoonotic disease in humans where infection occurs through the eating of raw or undercooked meat. Trichinella is also referred as the pork worm as it is mostly found in undercooked pork products. It is classified under OIE list B disease.

Keywords: Trichinellosis, Zoonosis

Introduction

Trichinella spiralis is the smallest known nematode parasite of human. The body of the worm is more slender at the anterior than the posterior end. In females the uterus is present in the posterior end of the worm and is filled with eggs. They have a large copulatory pseudo bursa on each side.¹

Classification

In addition to the classical agent T. spiralis, several other species has been also identified. T. pseudospiralis (from mammals and birds worldwide), T. nativa (from arctic bear and walrus), T. nelsoni (from African scavengers), T. britovi (from carnivores, pigs, horses of temperate Europe, western Asia and western Africa), T. murelli (from bears and horse in North America) and T. papuae (from wild and domestic pigs and salt water crocodiles in Papua New Guinea and Thailand).²

Susceptible hosts

All Trichinella species have relatively low host specificity and all mammals are susceptible to Trichinellosis including human. Birds are susceptible to Trichinella pseudospiralis. The infection is more common in omnivores (horse, human, pig, rat). pig and rodents play an important role in epidemiology of the disease.³

Risk factors

• The major risk factor for trichinosis is eating raw or undercooked meat, wild boar meat or other carnivore meat.
• The risk of developing infection depends on the amount of larva ingested.
• About 10 larva per gram of meat ingested result in severe infection. This can be eliminated by cooking meat to a uniform temperature of 70⁰ C or higher for at least a few minutes to kill the encysted larva. But this freezing technique is not effective for wild animals as Trichinella in
wild animals is usually not susceptible to freeze killing.
- Other cooking methods like microwaving, smoking, salting meat often fails to kill the encysted larvae, so the risk of getting infection from meat by these method is increased.4

Transmission

Disease in pig is due to garbage feeding, eating infected rodent carcass.

Transplacental transmission of larvae occurs in mice and humans, but not in pigs.

Human transmission is due to ingestion of raw meat.5

Habitat

- Adult worms live around the columnar epithelial cells of the small intestine and the larva live in the striated muscle of same animal. It has three different ecological cycle.
  1. The domestic cycle
  2. The sylvatic cycle
  3. The marine cycle.
- In the domestic cycle, transmission of disease occurs when pigs are being fed with uncooked pork scraps, garbage or carcasses.
- The infection may occur through synanthropic animals near the swine farm (rats).
- In sylvatic cycle predators and scavengers are host.
- In the marine cycle, seals, walrus, whales, polar bear act as host.6

Life cycle

- Among the different helminthes, Trichinella spp are unique because all three life cycles of the parasite, infective larvae and adult develop only in one host.
- Trichinella spiralis has a unique ability to make it encapsulated as a small cystic structure with in the infected host.
- When human takes the infected meat the larvae are released from the nurse cell due to acidic PH of stomach and migrate into small intestine, where they enter into the intestinal mucosa, undergo moulting and then become adult.
- Adult male and female worm mate and produce newborn larvae which then leave the small intestine via circulatory system to striated muscle. There they enter into individual muscle cell and modify the cells to specialized cysts called as nurse cell and become infective for other hosts.7

Nurse cell

The nurse is derived from a normal portion of striated skeletal muscle cell and develops after 20 days of invasion of larva. There is a hypoxic environment around the new vessel that regulate angiogenic cytokinin which allow T. spiralis larvae to enter and form nurse cell.8

Pathogenesis

Trichinella infection in human can be divided into two stages. One is intestinal phase and another is muscular or systemic phase.

- Infections with low intensity are generally asymptomatic. High burden of larva initially causes gastroenteritis with diarrhea and abdominal pain. It is due to larva released into the intestinal mucosa, with subsequent migration to blood vessels.
- Migrating Trichinella larva provoke an immediate reaction which causes immunological, pathological and metabolic disturbances. There is infiltration of inflammatory cells and in this case eosinophilia is a common characteristic. The release of histamine, serotonin, slow reacting substance of anaphylaxis, bradykinin alters the permeability of capillaries.

So there is leakage of fluids, electrolytes, albumins and cell elements into the surrounding resulting in tissue edema, mainly around the eyes. There is vasculitis and intravascular thrombi which is the principal pathology in the acute stage of Trichinellosis. During the acute stage, there are three important modifications are found.

1. The host cell transformation into nurse cell.
2. There is encapsulation of larvae.
3. The development a capillary network around the infected cell.9

Clinical signs

- Weakness and muscular twitching.
- Edema around eyes,
- Difficulty in respiration,
Consistent fever during migration and penetration of larvae in muscle tissues.
- Swelling of extremities,
- Maculopapular rash.
- Weakening of pulse and blood pressure,
- Damage to heart, nervous system and other organs.
- Facial nerve paresis.\(^{10}\)

**Complications**

All most all cases of trichinella infection have either minor or no symptoms and no complications. But in severe cases there may be myocarditis, pulmonary problems like coughing, breathlessness or CNS problems develop. These complications slowly resolve in 6 months to 1 year.\(^ {11}\)

**Diagnosis**

1. **Diagnosis of Trichinellosis** is based on clinical findings from the signs and symptoms,
2. **Laboratory findings:** Person suffering from Trichinellosis manifest leukocytosis along with eosinophilia and increased level of muscle enzymes (creatine phosphokinase, lactate dehydrogenase and aldolase) in blood.
3. Detection of specific anti-Trichinella antibody in blood serum is of great diagnostic value.
4. The confirmatory diagnosis of Trichinella is done by either serology or demonstration of parasite by muscle biopsy.
5. **Direct technique:** The disease is only diagnosed in animals at slaughter. Meat inspection for the detection of trichinella larvae is done to prevent clinical Trichinellosis in humans but not to prevent infection. Digestion of muscle is done by pepsin and HCl to release the parasite from the cyst and microscopic observation after filtration of the sample.
6. For identification of parasite, a special microscope called as trichinoscope is used for diagnosis. It consists of a compressorium to press muscle samples whose image is projected on a screen. Muscle sample is collected from many sites including diaphragm, cheek muscles and tongue. Samples are cut into at least 28 pieces of 2x10 mm in size which is recommended by OIE.
7. **Serological techniques:** ELISA is the most commonly used method for detection of Trichinella infection.

PCR technique helps in differentiation between different species of *Trichinella*.

8. **Epidemiological investigation:** At least one case of Trichinellosis outbreak must be laboratory confirmed. If two or more persons in the same household or a number of persons in the same community have high fever, periorbital edema and myalgia, then Trichinellosis can be suspected. In this case, correct identification of infection source is very important to prevent further source of infection.\(^ {12}\)

**Treatment**

Drugs administered in Trichinellosis are anthelmentics, glucocorticoids and compensation of electrolyte deficit. Symptoms can be relieved by use of analgesics and corticosteroids.

**Prevention and control**

- The best to prevent Trichinellosis is to cook meat to a safe temperature.
- USDA recommends the following for meat preparation
  - For whole cuts of meat: Cook to at least 63°C which can be measured by a food thermometer placed in the thickest part of the meat, then allow the meat to rest for 3 minutes before consuming.
  - For ground meat: cook to at least 71°C. ground meat does not require a rest time.
  - For poultry: cook to at least 74°C allow meat to rest for 3 minutes before consuming.
- Recommended freezing temperature and time to destroy *T. spiralis* are-
  - 15°C for 20 days, -23°C for 10 days, -30°C for 6 days, -35°C for 40 min.
- Restrict the use of uncooked garbage as feed for pigs.
- Here rest time is the amount of time the product remains at the final temperature, after it has been removed from a heat source. During the rest period the temperature of meat remains constant or continues to rise that destroys pathogens.
- Cooking by microwave ovens, curing, drying or smoking should not be done.
- If pigs are raised in indoor farms that can reduce the exposure to *Trichinella*.\(^ {13}\)

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References