Liver Flukes

- ***Faciola hepatica***
- ***Clonorchis sinensis***

Fascioliasis is an infectious disease caused by *Fasciola* parasites, which are flat worms referred to as liver flukes. The adult (mature) flukes are found in the bile ducts and liver of infected people and animals, such as sheep and cattle.

Two *Fasciola* species (types) infect people. The main species is *Fasciola hepatica*, which is also known as "the common liver fluke" and "the sheep liver fluke." A related species, *Fasciola gigantica*, also can infect people.

Transmission

- Occurs through the ingestion of raw, fresh water vegetation
- Plants become exposed to the **metacercariae** when the body of water that the vegetation is growing in becomes contaminated by eggs in the fecal mater of the infested host
- A form of infection known as halzoun (in the Middle East) is contracted by eating the raw liver of an infected animal

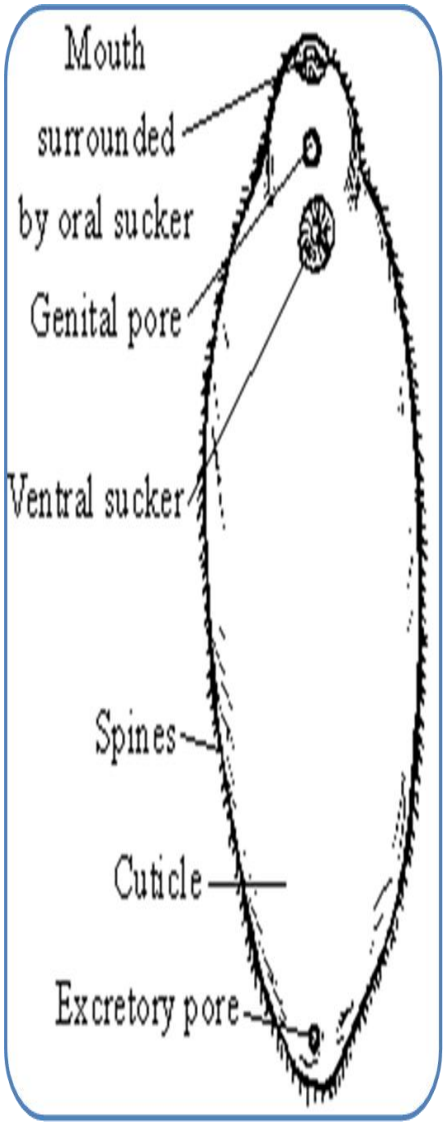
Geographical Distribution

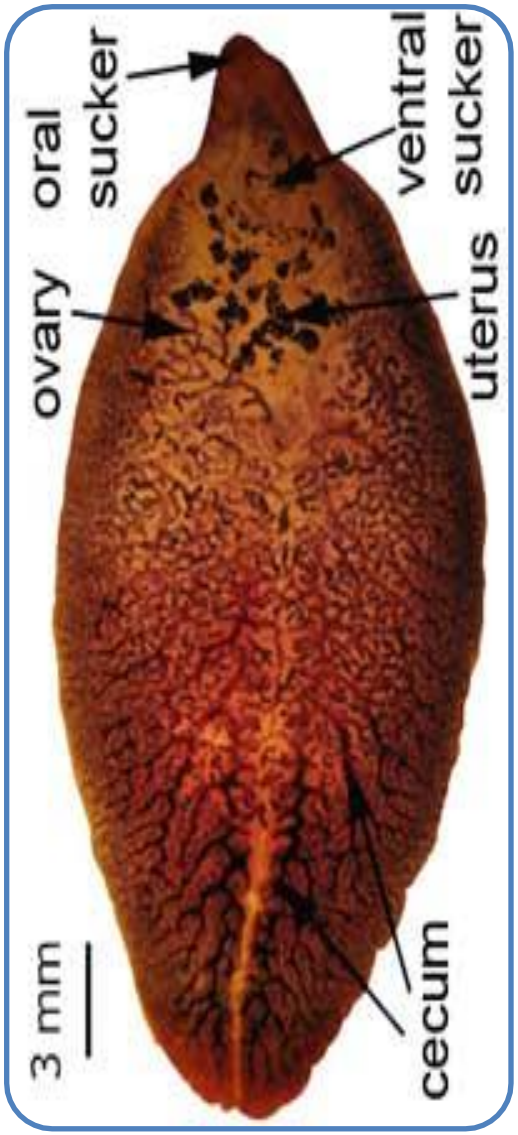
Fasciola hepatica is found in more than 50 countries, It is found in parts of Latin America, the Caribbean, Europe, the Middle East, Africa, Asia, and Ocean. *Fasciola gigantica* is less widespread. Human cases have been reported in the tropics, in parts of Africa and Asia, and also in Hawaii.

In some areas where fascioliasis is found, human cases are uncommon (sporadic). In other areas, human fascioliasis is very common (hyperendemic). For example, the areas with the highest known rates of human infection are in the of Bolivia and Peru.

Morphology of adult worm

-Reaching a length of 3 cm and a width of 1.5 cm.
- It is leaf-shape, pointed posteriorly, and wide anteriorly.
-The oral sucker is small the acetabulum is larger than the oral sucker and is anterior. -
The tegument is covered with large, and scale like spines.
- The intestinal ceca are extend to near the posterior end of the body.
-The testes are large and greatly branched, arranged in tandem behind the ovary.



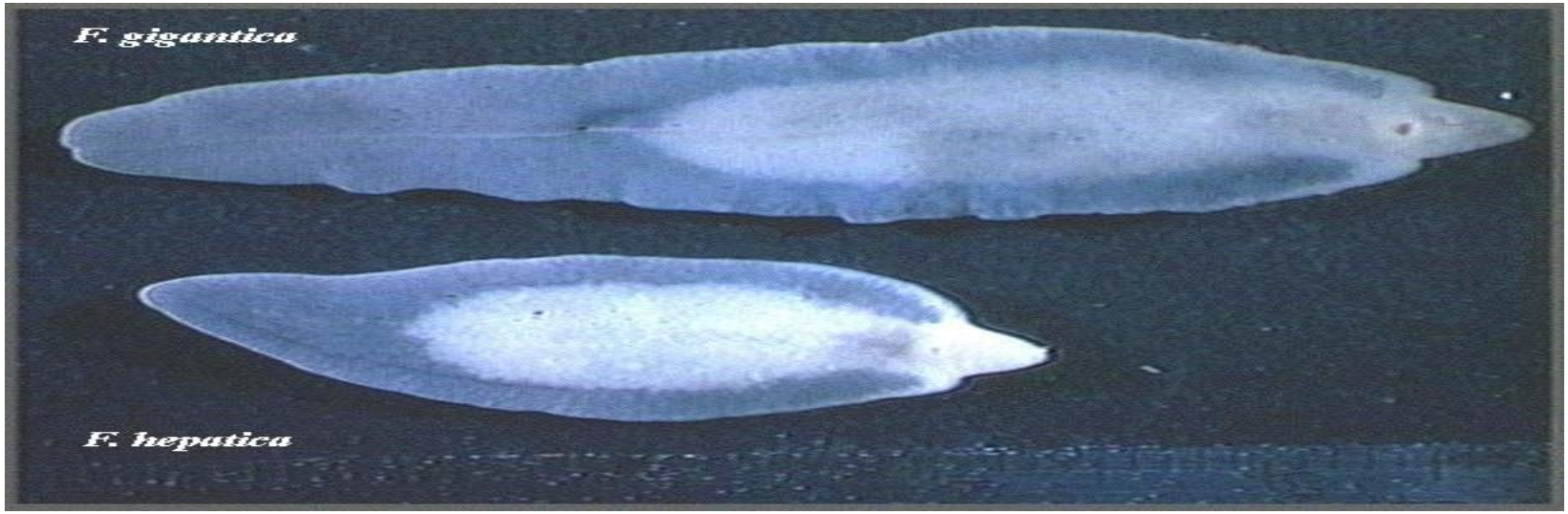


- **Egg**
- large in size measuring 130 to 140 um in length by 80 to 90 um in width
- oval in shape
- operculated and unembryonated.

Fasciola gigantica (Giant liver fluke)

adult worm

- Large may attain a length 7.4 cm
- More lanceolate
- Less developed shoulders (shorter cephalic cone)
- Larger ventral sucker
- The eggs are large.
- The life cycle of parasite is very similar to that of *F. hepatica*



- **Life cycle of *Fasciola spp***

  Fasciola require three host to complete the life cycle:
- Definitive host:
  - Sheep
  - Cattle
  - Humans (Accidental)
  - Other Mammals
- First Intermediate Host:
  - Fresh Water Snail

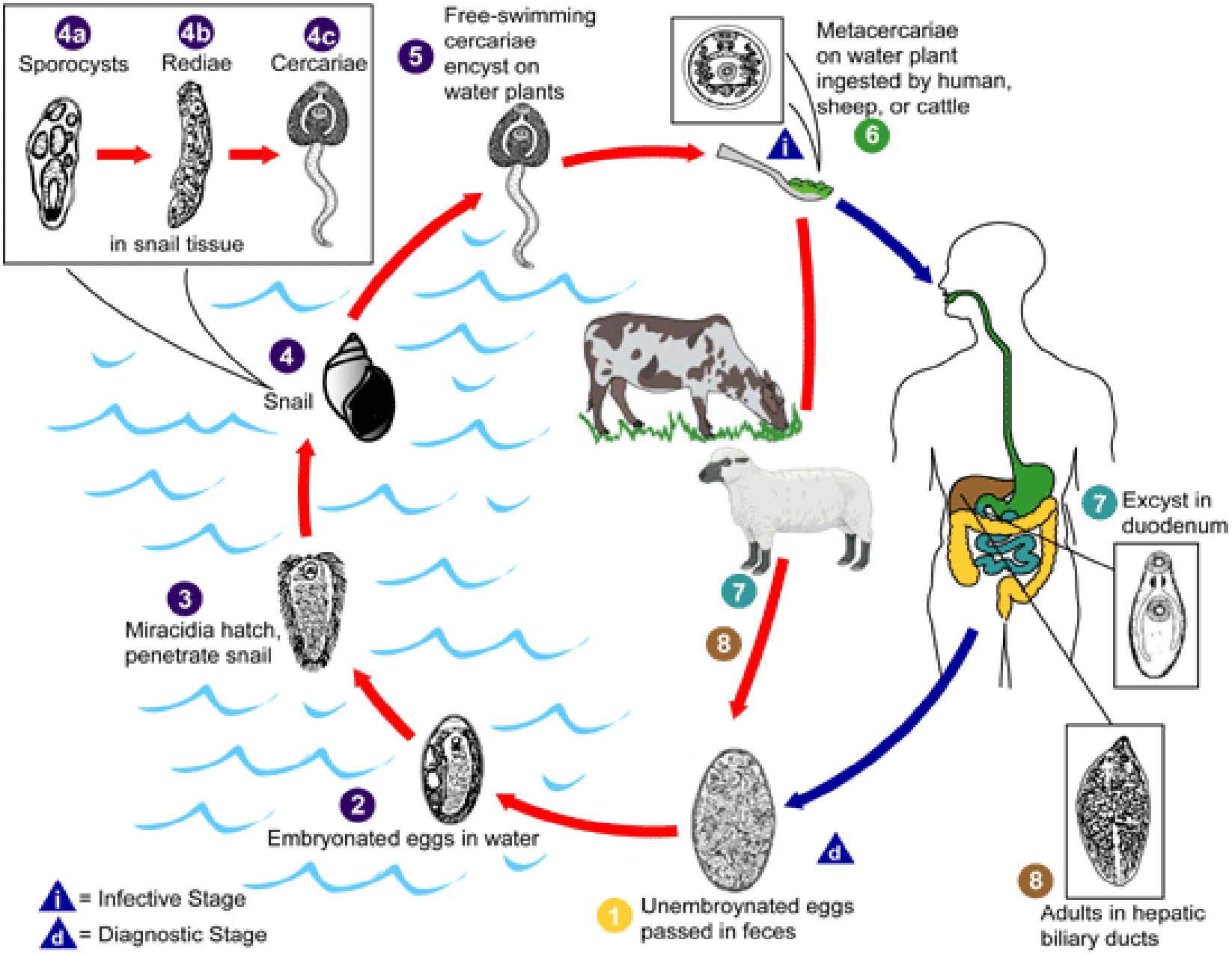
  Lymnea philippinensis
- Second Intermediate Host
  - Watercress
  - Grass

Life Cycle:

Fasciola parasites develop into adult flukes in the bile ducts of infected mammals, which pass immature *Fasciola* eggs in their feces. The next part of the life cycle occurs in freshwater. After several weeks, the eggs hatch, producing a parasite form known as the miracidium, which then infects a snail host. Under optimal conditions, the development process in the snail may be completed in 5 to 7 weeks; cercariae are then shed in the water. The cercariae lose their tails when they encyst as metacercariae (infective larvae) on water plants. In contrast to cercariae, metacercariae have a hard outer cyst wall and can survive for prolonged periods in wet environments.

Immature *Fasciola* eggs are discharged in the biliary ducts and in the stool . Eggs become embryonated in water , eggs release miracidia , which invade a suitable snail intermediate host. In the snail the parasites undergo several developmental stages (sporocysts , rediae , and cercariae). The cercariae are released from the snail and encyst as metacercariae on aquatic vegetation or other surfaces. Mammals acquire the infection by eating vegetation containing metacercariae. Humans can become infected by ingesting metacercariae-containing freshwater plants, especially watercress . After ingestion, the metacercariae excyst in the duodenum and migrate through the intestinal wall, the peritoneal cavity, and the liver parenchyma into the biliary ducts, where they develop into adultflukes.

In humans, maturation from metacercariae into adult flukes takes approximately 3 to 4 mounths


4a
Sporocysts
4b
Rediae
4c
Cercariae
in snail tissue
5
Free-swimming cercariae encyst on water plants
Metacercariae on water plant ingested by human, sheep, or cattle
6
i
4
Snail
3
Miracidia hatch, penetrate snail
7
Excyst in duodenum
8
2
Embryonated eggs in water
1
Unembroynated eggs passed in feces
d
8
Adults in hepatic biliary ducts
i = Infective Stage
d = Diagnostic Stage

signs &Symptoms

Human fascioliasis is usually recognized as an infection of the bile ducts and liver, but infection in other parts of the body can occur.In the early (acute) phase, symptoms can occur as a result of the parasite's migration from the intestine to and through the liver. Symptoms can include gastrointestinal problems such as nausea, vomiting, and abdominal pain/tenderness. Fever, rash, and difficulty breathing may occur.

During the chronic phase (after the parasite settles in the bile ducts), the clinical manifestations may be similar or more discrete, reflecting inflammation and blockage of bile ducts, which can be intermittent. Inflammation of the liver, gallbladder, and pancreas also can occur.

Clinical Presentation:

Up to 50% of *Fasciola hepatica* infections are asymptomatic and disease may appear anywhere from a few days to several years after infection .

Eosinophilia is present with all infections at all stages and can be used as a diagnostic factor .

When symptoms do appear, they occur in the following patterns:

Acute Phase : The acute phase of infection is rarely seen in humans and occurs only when a large number of metacercariae are ingested at once. Fever, tender hepatomegaly, and abdominal pain are the most frequent symptoms of this stage of infection although vomiting, diarrhea, urticaria (hives), anemia, and may all be present.

The above characteristics of the acute phase are caused by the migration of the *F. hepatica* larvae throughout the liver parenchyma. The larvae penetrate the liver capsule and begin to produce the above symptoms 4-7 days after ingestion. Migration and thus the acute phase continues for 6-8 weeks until the larvae mature and settle in the bile ducts.

Chronic Phase The symptoms of chronic infection are include biliary cholic, abdominal pain, tender hepatomegaly, and jaundice. In children, severe anemia is a common result of infection and is the greatest source of disability from infection in this age group. These symptoms reflect the biliary obstruction and inflammation caused by the presence of the large adult worms and their metabolic waste in the bile ducts. Inflammation of the bile ducts eventually leads to fibrosis and a condition called "**pipestem liver**", a term describing the white appearance of the biliary ducts after fibrosis. The final outcome of severe infections is portal cirrhosis and even death.

Halzoun The condition commonly known as halzoun is a type of *Fasciola hepatica* infection in which the worm settles in the pharynx. This occurs when an individual consumes infected raw liver. The young adult worms then attach themselves to the pharyngeal mucosa which causes considerable pain, edema, and bleeding that can interfere with respiration. The adults can live in the biliary ducts, causing symptoms for up to 10 years.

Chronic Phase The symptoms of chronic infection are much more common in human populations and include biliary cholic, abdominal pain, tender hepatomegaly, and jaundice. In children, severe anemia is a common result of infection and is the greatest source of disability from infection in this age group. These symptoms reflect the biliary obstruction and inflammation caused by the presence of the large adult worms and their metabolic waste in the bile ducts. Inflammation of the bile ducts eventually leads to fibrosis and a condition called "**pipestem liver**", a term describing the white appearance of the biliary ducts after fibrosis. The final outcome of severe infections is portal cirrhosis and even death.

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Diagnosis

Fasciola hepatica egg in an unstained wet mount

The standard way to be sure a person is infected with *Fasciola*is by seeing the parasite. This is usually done by finding *Fasciola* eggs in stool (fecal) specimens examined under a microscope. More than one specimen may need to be examined to find the parasite. Sometimes eggs are found by examining duodenal contents or bile.

Infected people don't start passing eggs until they have been infected for several months; people don't pass eggs during the acute phase of the infection. Therefore, early on, the infection has to be diagnosed in other ways than by examining stool.

Certain types of blood tests can be helpful for diagnosing*Fasciola* infection, including routine blood work and tests that detect antibodies (an immune response) to the parasite.

Treatment

The first step is to make sure the diagnosis is correct.

The drug of choice is triclabendazole. In the United States, this drug is available, under a special (investigational) protocol. The drug is given by mouth, usually in one or two doses. Most people respond well to the treatment.

Clonorchis sinensis

the Chinese liver fluke or oriental liver fluke, This parasite lives in the liverof humans, and is found mainly in the common bile duct and gall bladder, feeding on bile. These animals, which are believed to be the third most prevalent worm parasite in the world, are endemic to Japan, China, Taiwan, and Southeast Asia, currently infecting an estimated 30,000,000 humans.85% of cases are found in China.

It is the most prevalent human trematode in Asia, and still actively transmitted in Korea, China, Vietnam and also Russia, with 200 million people at constant risk. Recent studies have proved that it is capable of causing cancer of liver and bile duct

1-This trematode differs from other fluke cycles because the eggs are eaten by the snail, then reproduction begins in the soft tissues of the snail.

2- *C. sinensis* also requires a second intermediate host, freshwater fish, where the cercariae encyst and develop into infective metacercariae .

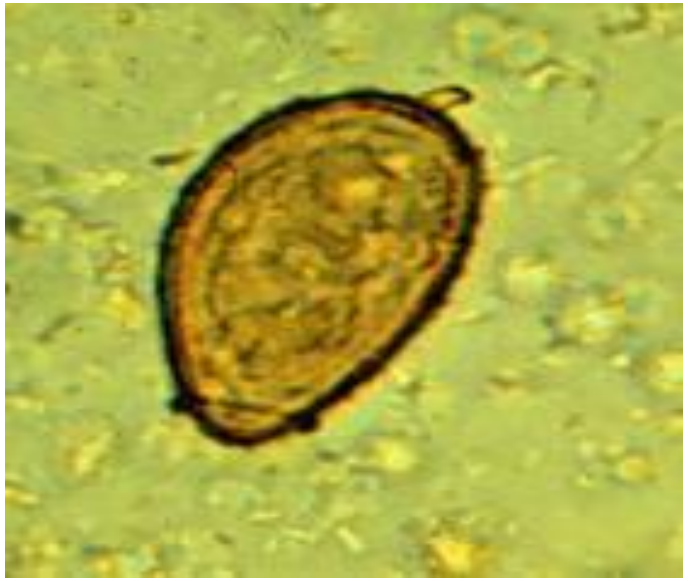
Transmission

The eggs of *Clonorchis sinensis* are ingested by snails in fresh water. After the eggs hatch, infected snails will release larvae that will enter freshwater fish. People become infected when eating the parasite containing cysts within infected raw or undercooked fish. Once ingested, cysts travel to the small intestine and liver where they feed upon the bile created by the liver and mature. The life cycle takes 3 months to complete in humans. Infected people will then pass eggs in their feces or may cough them up.

Clonorchis sinensis

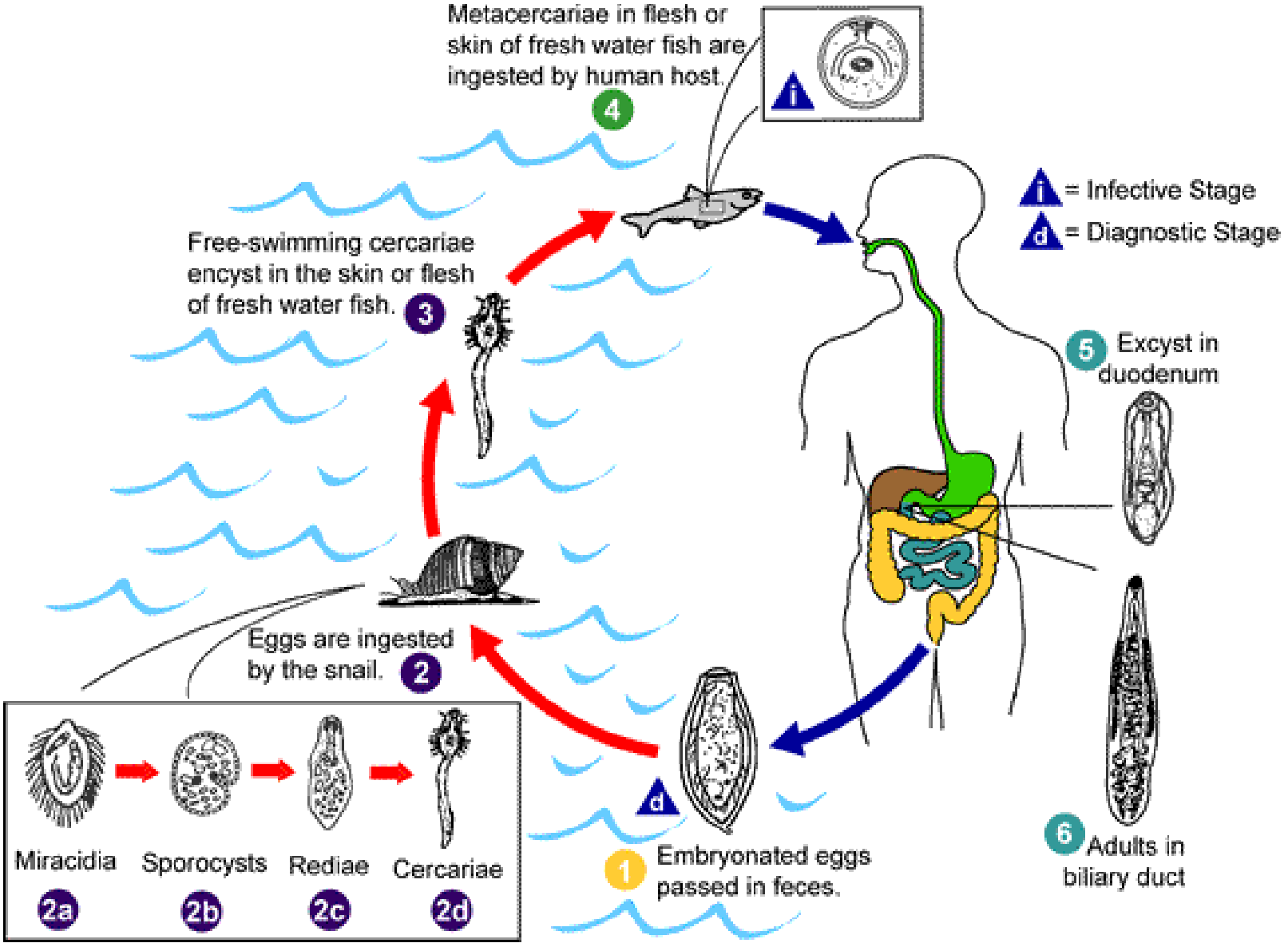
- Adult Worm
  - Narrow, oblong, flat worm
  - branching testes posterior and one ovary round in shape.
  - Oral sucker is slightly larger than the ventral sucker
  - Blind intestinal caeca are simple and extend to the caudal region
  - Life span is 20-30 years.

- **Ova**
  - Contain fully developed miracidia
  - Bile stained
  - Flask-shaped
  - Operculated
  - Does not hatch in water but is ingested with a molluscan host
  - Has a terminal spine
  - Infective to snails only



Life Cycle

Embryonated eggs are discharged in the biliary ducts and in the stool . Eggs are ingested by a suitable snail intermediate host . Each egg releases a miracidia , which go through several developmental stages.The cercariae are released from the snail and after a short period of free-swimming time in water, they come in contact and penetrate the flesh of freshwater fish, where they encyst as metacercariae . Infection of humans occurs by ingestion of undercooked, salted, pickled, or smoked freshwater fish . After ingestion, the metacercariae excyst in the duodenum and ascend the biliary tract through the ampulla of Vater . Maturation takes approximately 1 month. The adult flukes (measuring 10 to 25 mm by 3 to 5 mm) reside in small and medium sized biliary ducts. In addition to humans, carnivorous animals can serve as reservoir hosts .


Metacercariae in flesh or skin of fresh water fish are ingested by human host.
4
i
i = Infective Stage
d = Diagnostic Stage
Free-swimming cercariae encyst in the skin or flesh of fresh water fish.
3
5 Excyst in duodenum
Eggs are ingested by the snail.
2
Miracidia
Sporocysts
Rediae
Cercariae
2a
2b
2c
2d
d
1 Embryonated eggs passed in feces.
6 Adults in biliary duct

Signs and symptoms

Most signs and symptoms are related to inflammation and intermittent obstruction of the biliary ducts. In severe cases, abdominal pain, nausea, and diarrhea can occur. In long-standing, untreated infections, inflammation of the biliary system can lead to cancer, which can be fatal.

Diagnosis

Detection of parasite egg in stool
ELISA with crude *Clonorchis sinensis* antigen
Enzyme immunoassay (EIA)
Polymerase Chain Reactions

Treatment

- Praziquantel
  - 25 mg/kg three times a day for two days
  - 60 mg/kg in three doses for one day
  - May be used together with albendazole for light and moderate infections