



The Trematodes

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PROTOZOA

HELMINTHS

Unicellular
Single cell for all functions

Multicellular
Specialized cells

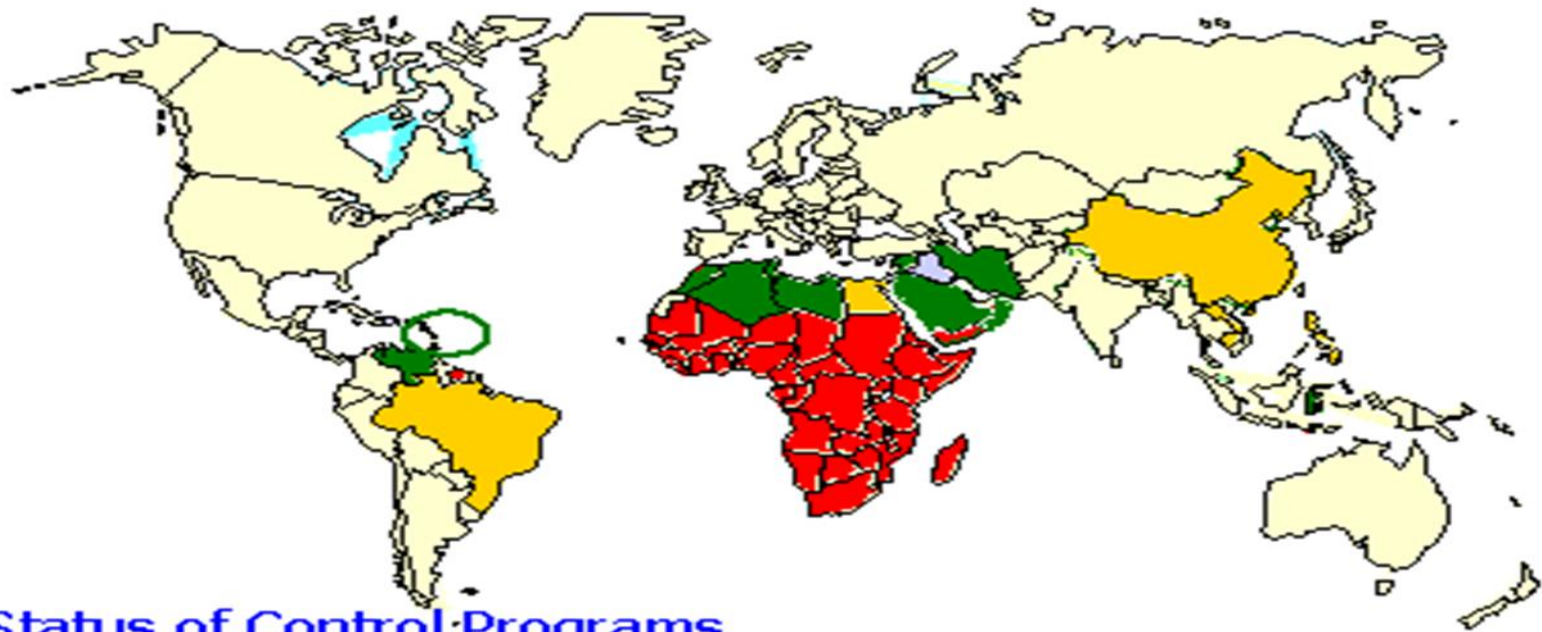
1:Amoebae: move by pseudopodia.
2:Flagellates: move by flagella.
3:Ciliates: move by cilia
4:Apicomplexa(Sporozoa)
tissue parasites

Round worms (Nematodes):
- elongated, cylindrical, unsegmented.
Flat worms :
- **Trematodes:** leaf-like, unsegmented.
- Cestodes: tape-like, segmented.

Blood Flukes

Schistosoma spp

Global Distribution of Schistosomiasis



Status of Control Programs



Source: WHO

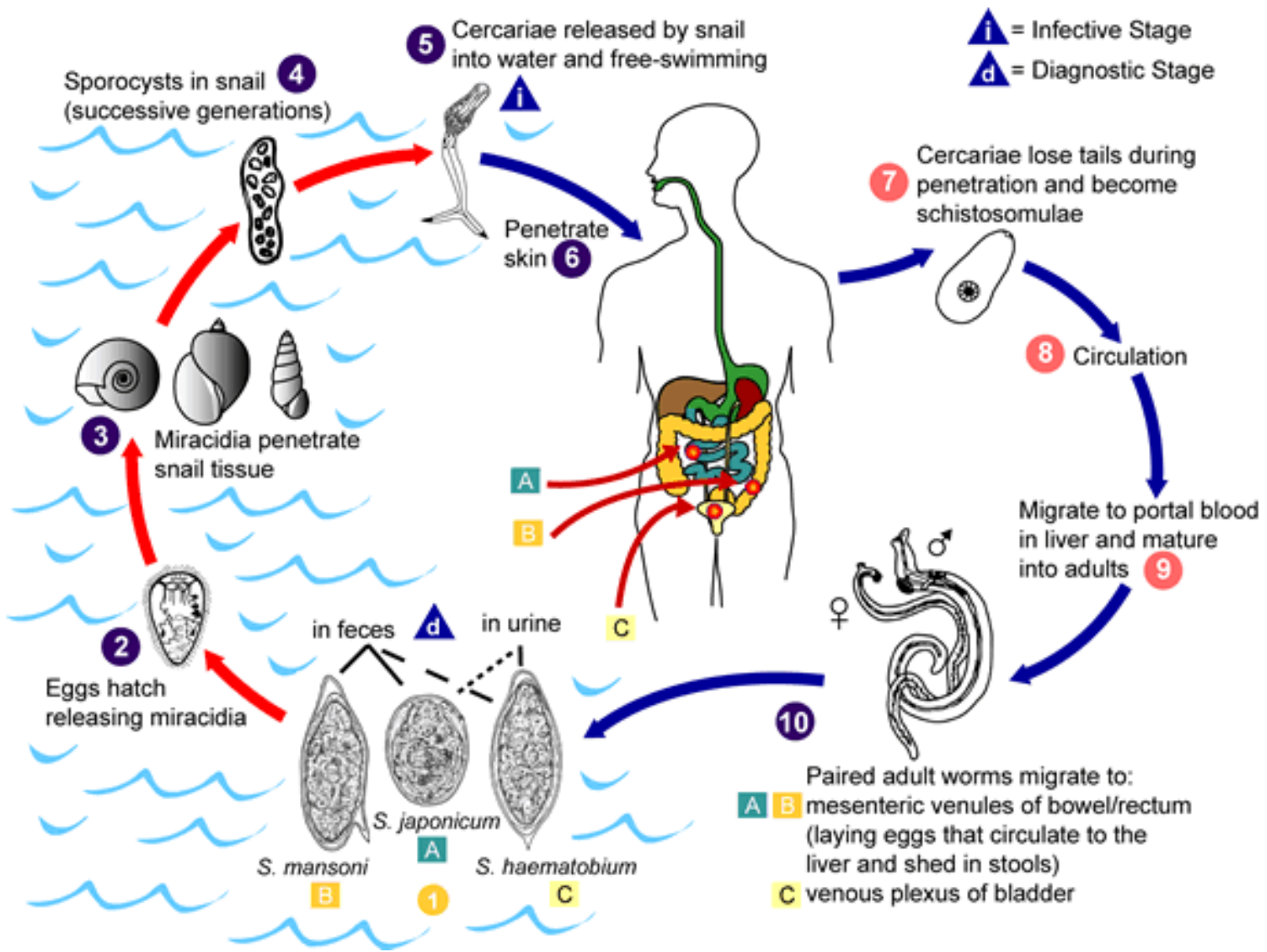


Schistosom

A genus of trematodes, *Schistosoma*, commonly known as **blood-flukes**, are parasitic flatworms responsible for a highly significant group of infections in humans termed schistosomiasis. Schistosomiasis is considered by the World Health Organization as the second most socioeconomically devastating parasitic disease, (after malaria), with hundreds of millions infected worldwide.

Adult flatworms parasitize **blood capillaries** of either the
1-**mesenteries** (*Schistosoma mansoni*)

2-**plexus of the bladder** (*Schistosoma haematobium*), depending on the infecting species



Paired adult worms migrate to:
 ▲ A mesenteric venules of bowel/rectum (laying eggs that circulate to the liver and shed in stools)
 ▲ B venous plexus of bladder
 ▲ C

Schistosoma spp

CERCARIA IS THE INFECTIVE STAGE.

Cercaria emerge from snail in the water and penetrate the skin of the human.

The **cercaria** is transformed into a **schistosomulae** inside the host tissues.

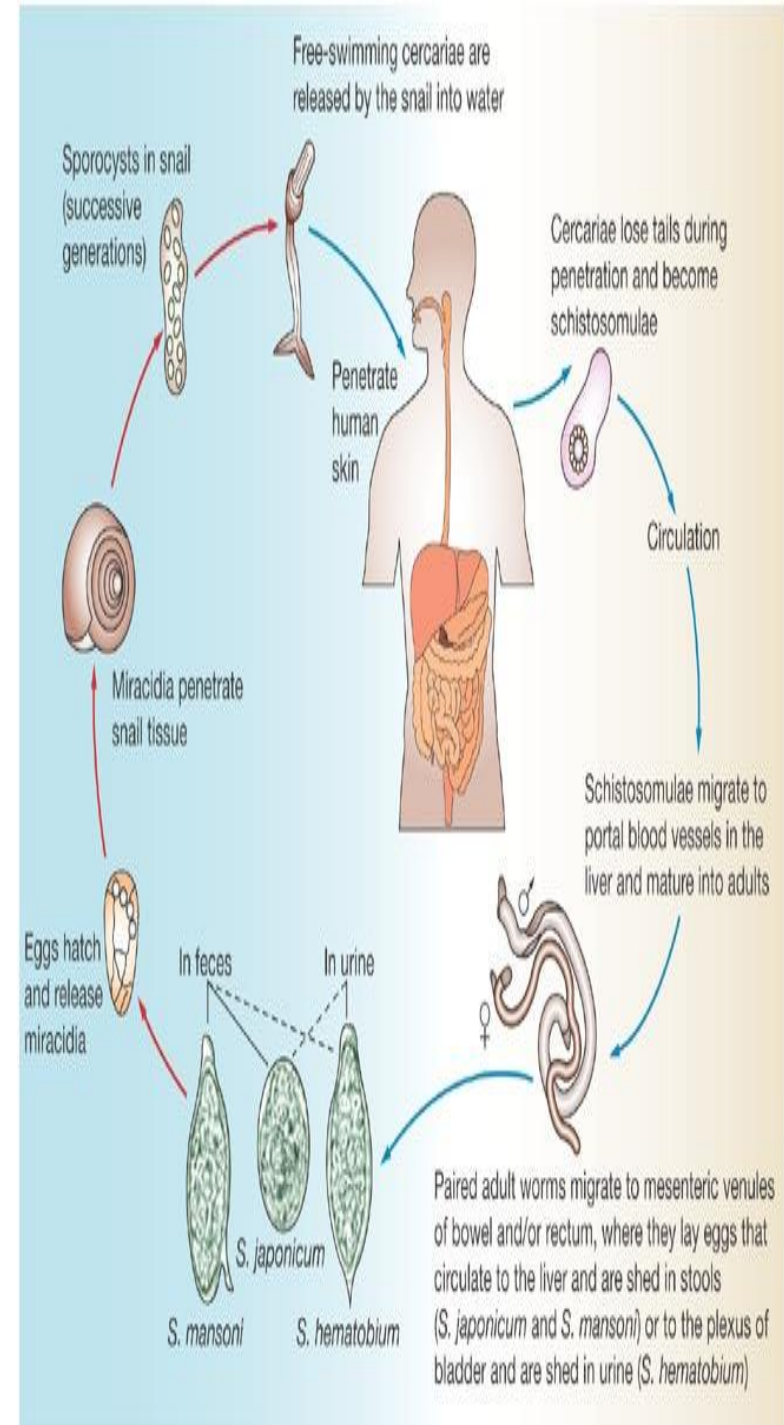
The **schistosomulae** first enters the systemic circulation and then finds its way into 1- **the portal circulation** (*S.mansoni* & *S.japonicum*) worms mature in the **mesenteric veins of the portal circulation**
2-, *S.haematobium* worms generally remain in the systemic circulation and mature in the blood vessels of the **vesical and venous plexus**.

THE EGG IS THE DIAGNOSTIC STAGE

The eggs of *S.mansoni* & *S.japonicum* are passed **mainly in stool** and *S.haematobium* passed **mainly in the urine**.

MAN is the **DEFENITIVE HOST** .

SNAILS is the **INTERMEDIATE HOST** .



PATHOLOGY:

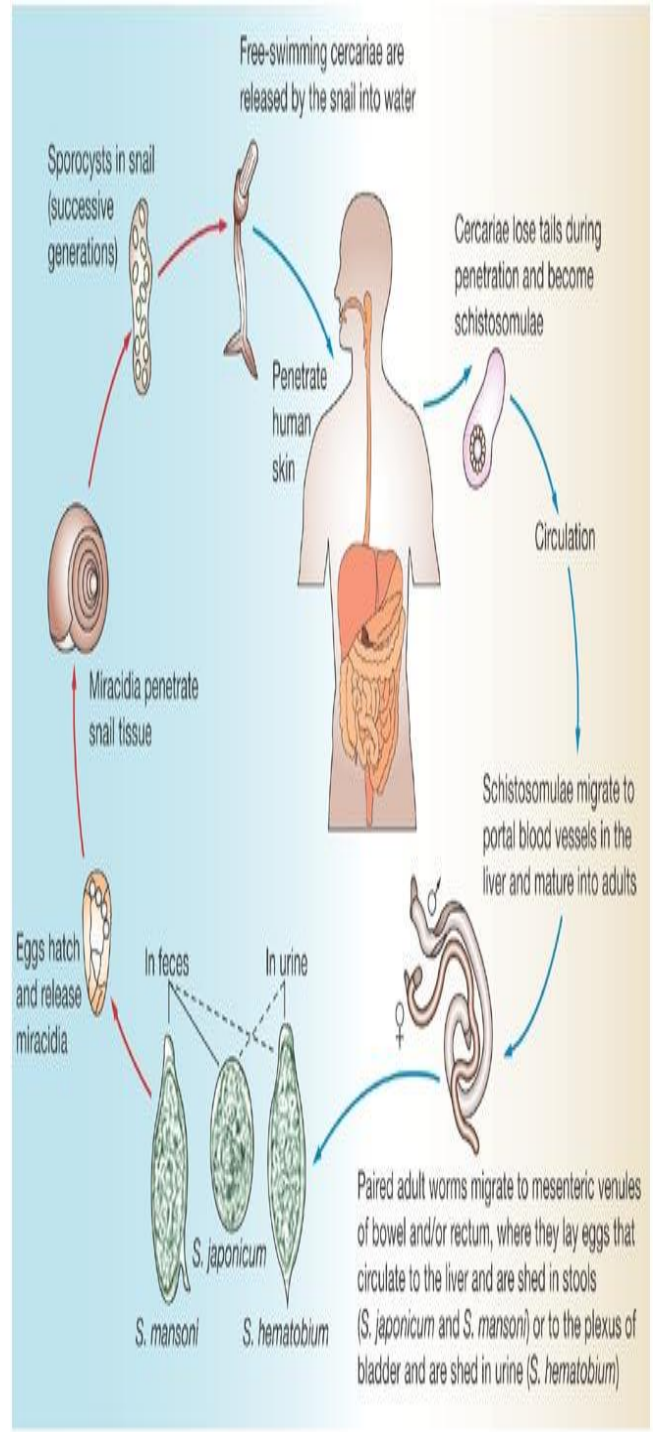
- **The EGG is the main cause of pathology in schistosomiasis . Many eggs become stranded in the tissues or are carried by the blood stream to other organs mainly the LIVER. The host reaction to the eggs may vary from small granulomas to extensive fibrosis .The extent of damage is generally related to the number of eggs present in the tissues.**

After the eggs of the human-infected with *S.mansoni* & *S.japonicum* are passed in the feces into the water Or the eggs are passed during micturition from host infected with *S.haematobium* .

the **miracidium** hatches out of the egg and searches for a suitable freshwater **snail** to act as an intermediate host . In the snail the miracidium develops to cercaria. From a single miracidium result a few thousand cercaria, every one of which is capable of infecting a human

Cercaria emerge from snail in the water and penetrate the skin of the human .The cercaria is transformed into a schisosomula inside the host tissue.

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The cercaria emerge from the snail during daylight and they actively seeking out their final host. When they recognize human **skin and become schistosomula**,

Each schistosomule spends a few days in the skin and then enters the circulation starting at the dermal lymphatic and venles, they feed on blood.

The schistosomule migrates to the **lung** and then moves via circulation through the left side of the **heart** then it develops into a sexually mature adult and the pair migrate to the mesenteric veins (*S.mansoni* & *S.japonicum*) or to urinary bladder veins (*S.haematobium*).

The female fluke (***S.haematobium***) lays as many as 30 eggs per day which migrate to the lumen of the urinary bladder and ureters

Each female of (***S.mansoni* & *S.japonicum***) layes 300 eggs a day the eggs move into the **lumen** of the host's **intestines** and are released into the environment with the feces .



Shistosoma
Cercaria

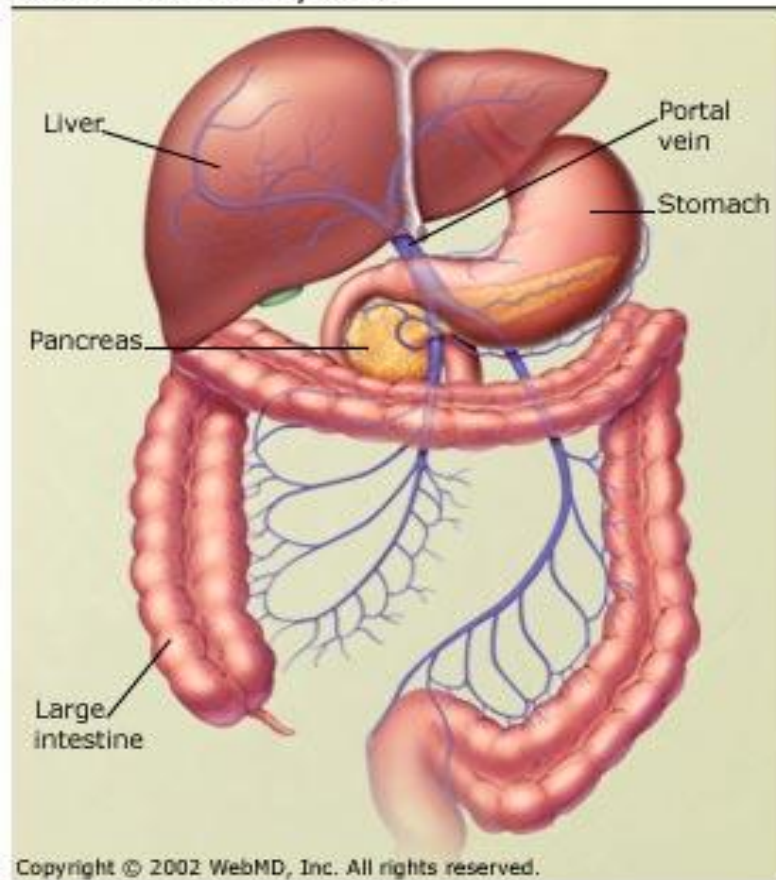


Schistosome dermatitis, or "swimmers itch" occurs when skin is penetrated by a free-swimming, fork-tailed **infective cercaria**. The dermatitis often develops 24 hours after exposure and last for 2 to 3 days and then spontaneously disappears.

Pathogenicity of Schistosomiasis

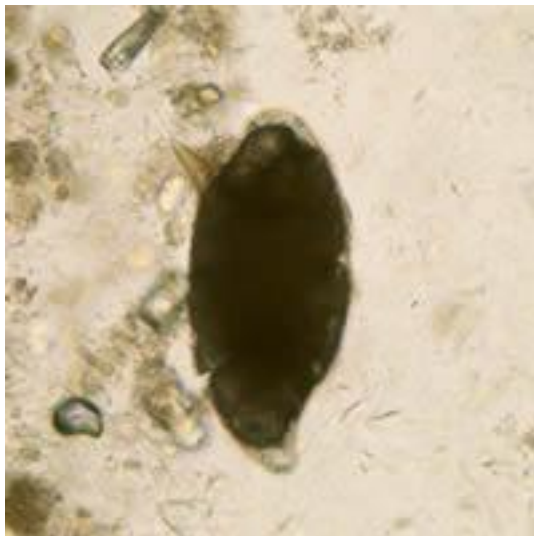
- 1-Cercarial dermatitis: at the site of entry of cercaria.
- 2-Toxic Metabolites: liberated during the growth of schistosomulae in the circulation veins, may cause anaphylactic reaction ,fever ,urticarial rashes and eosinophilia.
- 3-Terminal spined eggs : may erode blood vessels and cause hemorrhages. Schistosome eggs, deposited in the tissues, act as foreign protein ,cause irritation leading to cell infiltration and connective tissue hyperplasia ,egg granuloma around each egg (cell mediated immunity) .

Portal Venous System



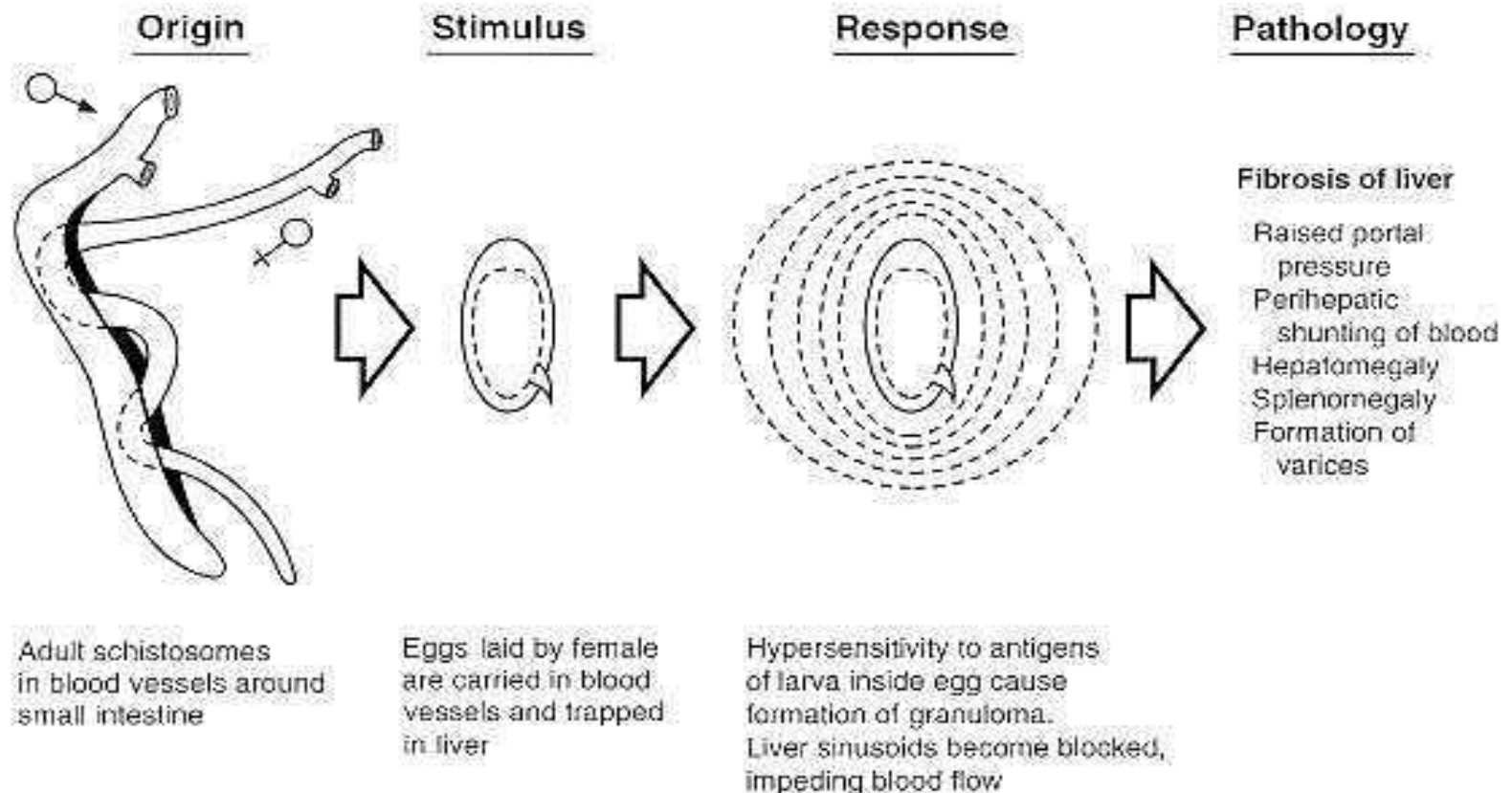
Developing schistosome in liver:

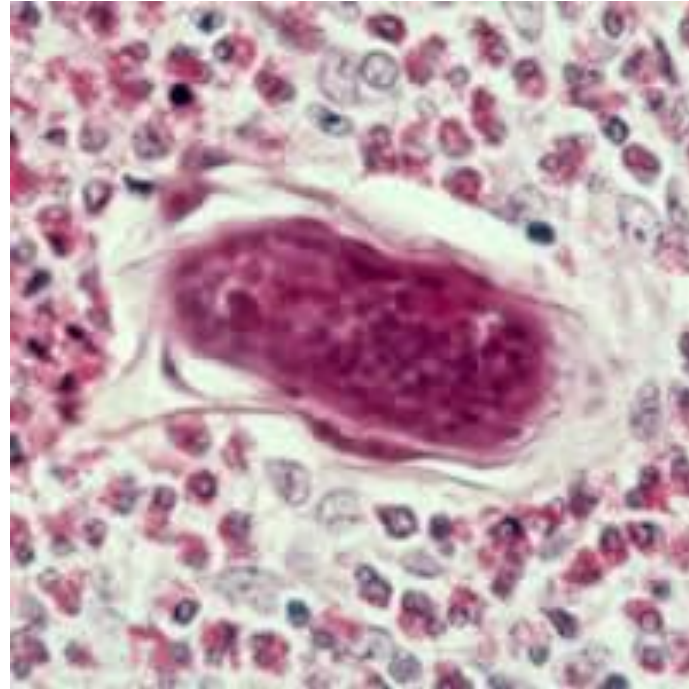
S. mansoni & *S. japonicum* located mainly in **mesenteric vein** and its branches, the worm discharges **EGGS**, the eggs travel in 2 directions : 1- some eggs find their way into the lumen of the bowel and appear in the feces . 2- other flow with blood stream in the portal circulation and enter **the LIVER**. Most of these eggs are trapped in the liver and give rise to pathology as ,fibrosis of the liver caused from eggs settled in the liver may produce **portal hypertension ,which may lead to hepatomegaly ,splenomegaly, esophageal varices ,hemorrhoids and ascites.**



Eggs of
Schistosoma
***mansoni* with**
lateral spine

Schistosoma mansoni

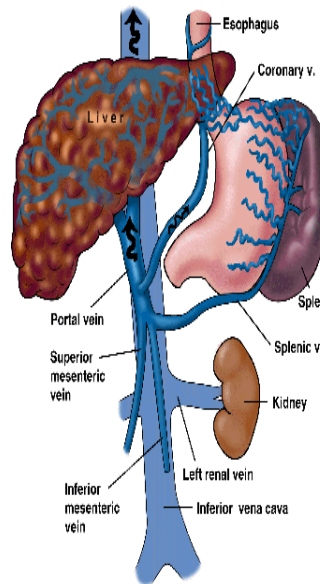




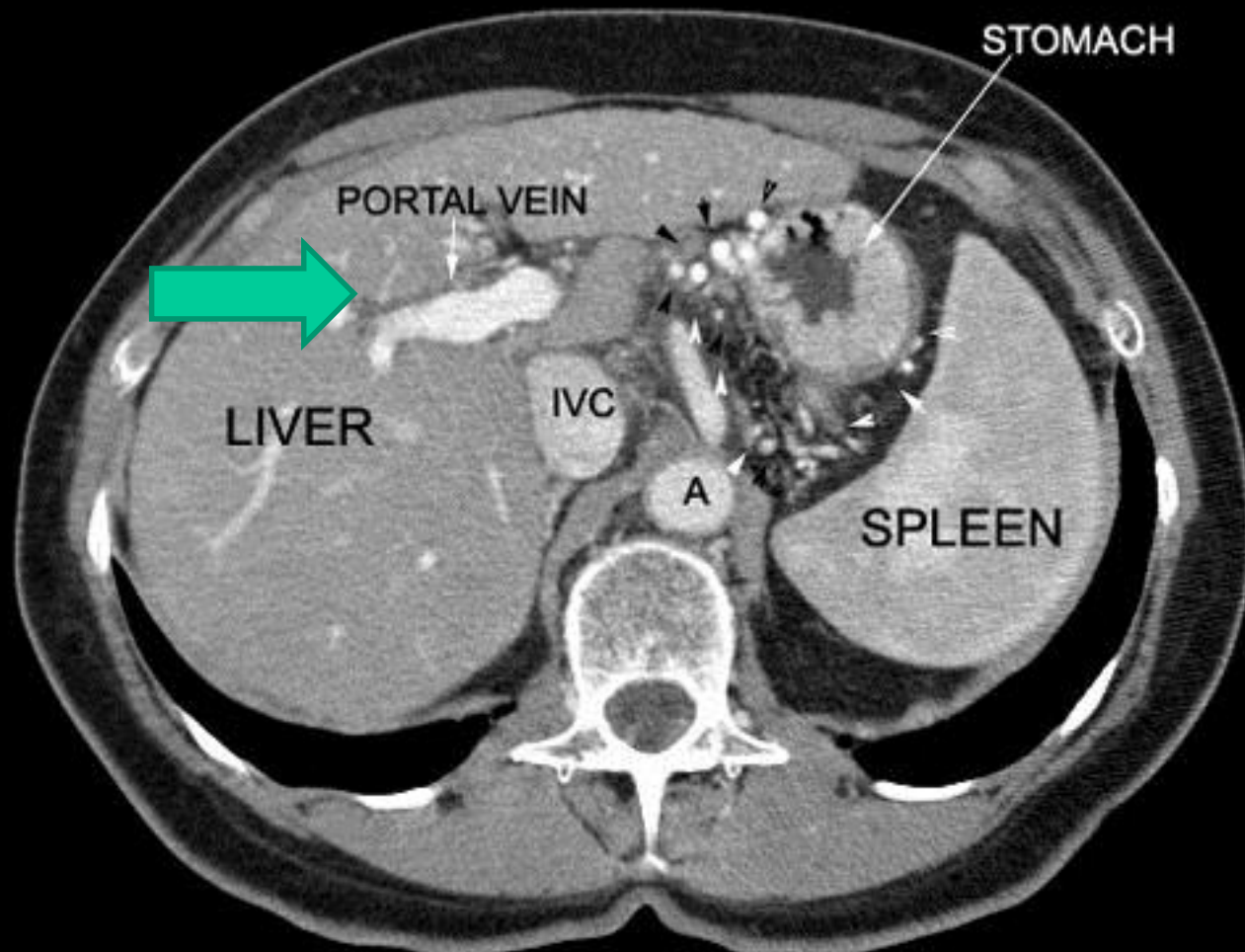
Eggs of *Schistosoma mansoni*
in the liver and cellular reaction.

**Hepatomegally
and splenomegally
with ascites.**

**Portal
hypertension
in chronic
schistosomiasis**



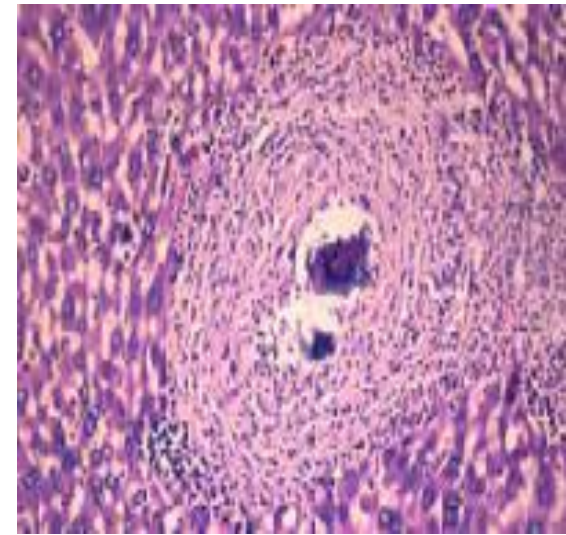
PORTAL HYPERTENSION



THE PORTAL VEIN IS ENLARGED. ARROWHEADS POINT TO THE PERI GASTRIC VARICES.

S. haematobium :

*the worm is located in the vesical venous plexus surrounding the urinary bladder .Many **eggs** are trapped in the wall of the bladder where they may give rise to calcification and granuloma formation .Constriction of the orifice of the ureter may produce kidney damage , hydronephrosis and cancer of the bladder.*



Egg of *S. haematobium*

Pathology of Schistosomiasis

- **Schistosoma haematobium**

- Causes urinary schistosomiasis

1. PREPATENT PERIOD 10-12 wks
2. EGG DEPOSITION AND EXTRUSION:
 1. painless haematuria
 2. Inflammation of bladder and burning micturition
 3. CNS involvement (rare)
3. TISSUE PROLIFERATION AND REPAIR:
 - Fibrosis , papillomata in the bladder and lower ureter leading to obstructive uropathy.
 - Periportal fibrosis
 - Lung and CNS involvement

- **Schistosoma mansoni**

- Causes intestinal schistosomiasis

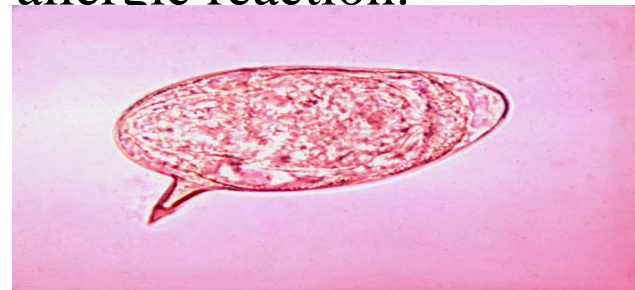
1. PREPATENT PERIOD 5-7 wks
2. EGG DEPOSITION AND EXTRUSION:
 1. dysentery (blood and mucus in stools),
 2. hepatomegaly splenomegaly
 3. CNS involvement (rare)
3. TISSUE PROLIFERATION AND REPAIR:Fibrosis ,
 - Papillomata in intestine,
 - Pperiportal fibrosis,hematemesis
 - Lung and CNS involvement.

Diagnosis of Schistosomiasis

- *Schistosoma haematobium*
- *Microscopical:*
 - Examination of urine
- *Immunological*
 - Serological tests CFT ,ELIZA
- *Indirect:*
 - Radiological
 - Cystoscopy
- *Intradermal test :*
- With cercarial antigen cause allergic reaction

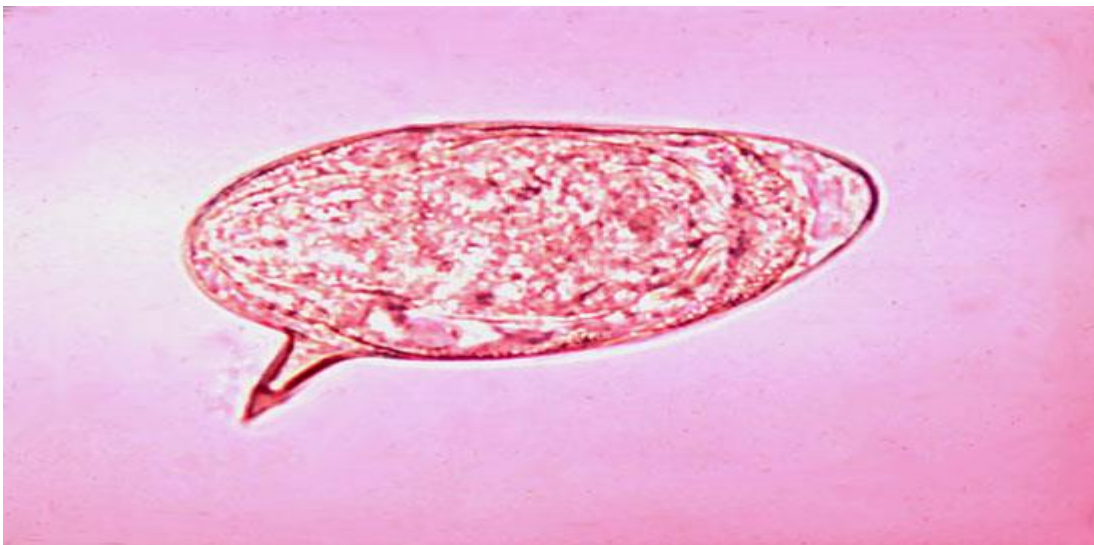


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Egg of *S. haematobium*



Egg of *S. mansoni*



Drug of choice for schistosomiasis is
Praziquantel

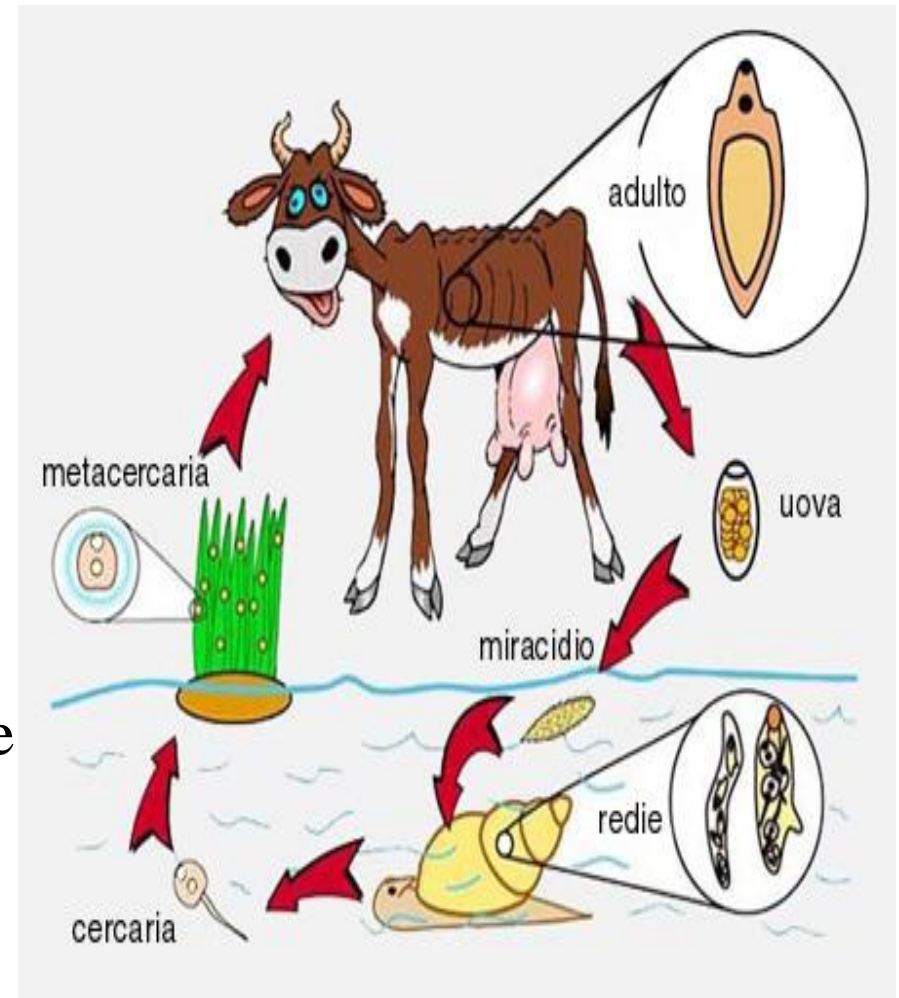
Life cycle of Fasciola hepatica

LIVER FLUKE

How is Fasciola hepatica transmitted to man?

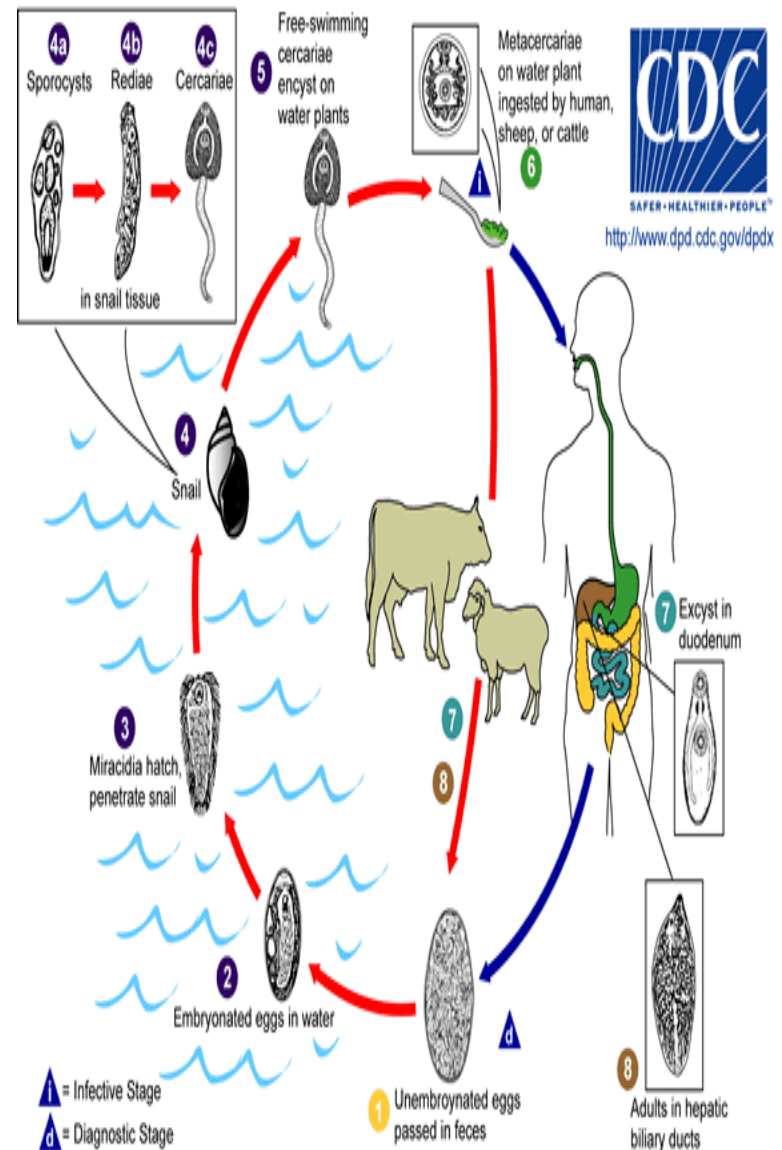
By ingestion of raw, fresh –water vegetation contaminated with the **METACERCARIA**.

METACERCARIA ,excyst in the duodenum ,migrate through intestinal wall to the liver and settle in the biliary tract, Then grow into adult worm And liberate eggs in bile , throw bile eggs reach the intestine and then passed in stool.



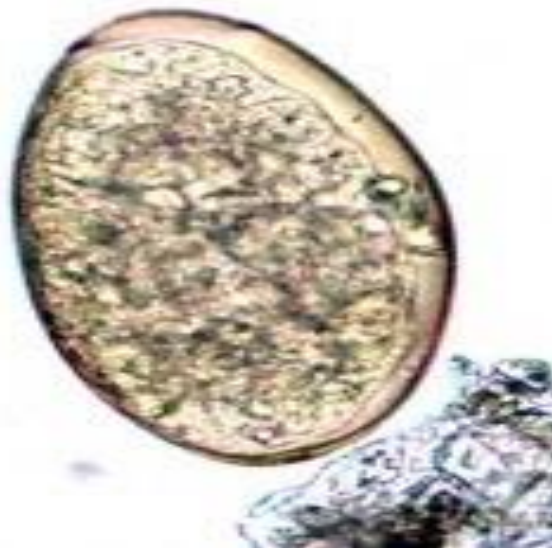
Life-cycle of *Fasciola hepatica*

- **DEFENITIVE HOST**
- Sheep ,cattle ,goat and MAN.
- **INTERMEDIATE HOST:** SNAILS.
- **INFECTIVE STAGE:** **METACERCARIA**
- _ingested with contaminated grasses.
- **.DIAGNOSTIC STAGE:**
- **EGGS PASS IN STOOL OR IN THE DUODENAL ASPIRATE**





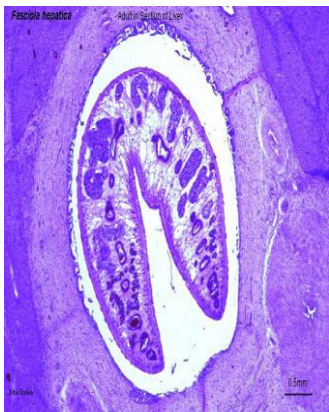
Fasciola hepatica
worm in the
definitive host



Egg of *Fasciola hepatica*
can be
seen in true
patient's stool or in
false infection.



Snail intermediate
host of :
Fasciola hepatica



Fasciola hepatica in bile duct



Watercress , one
means of
transmission of
fascioliasis

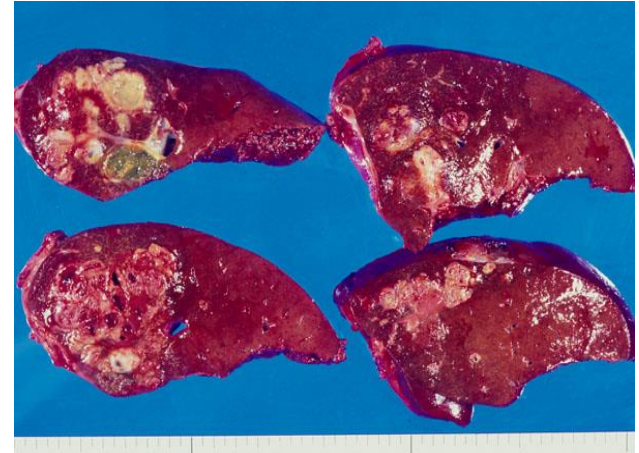


Snail intermediate host of :
Fasciola hepatica

Fasciola hepatica

- Pathology and clinical picture :
 - **True infection** : occur when man ingests water plant (watercress) contaminated with **METACERCARIA** , the adult worm can causes mainly biliary colic with **biliary obstruction**, **jaundice**, generalised abdominal pain ,cholecystitis and cholithiasis.
 - **False infection is when eggs are eaten in infected animal liver and passed in stools.**
- Diagnosis: eggs in stools or duodenal aspirate.
- Serological Test :CFT and skin test are also used.
- Treatment: Triclabendazole.

Fasciola hepatica: false infection will not lead to liver infection only we can detect eggs in stool after eating rot cattle liver infected with Fasciola Hepatica so we can find the eggs in stool but patient is not infected.



Sheep liver infected
with *Fasciola hepatica*



TREATMENT

Triclabendazole is the drug of choice to treat fascioliasis and is on the WHO list of essential medicines.

The correct dosage is calculated based on the person's weight (10 mg/kg) and the tablets are given at one time.

