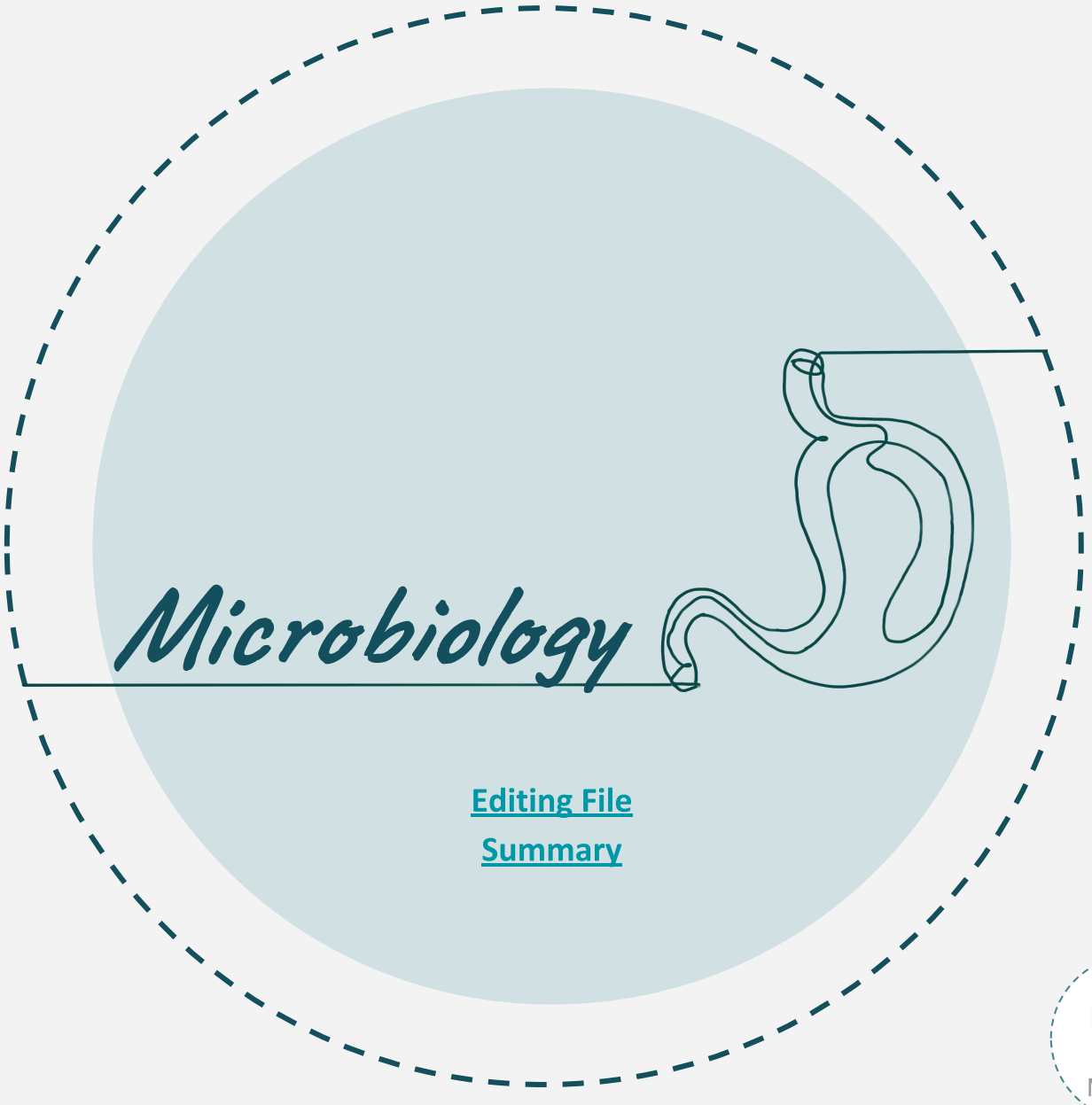
Schistosomiasis
(البلهارسيا)



Editing File

Summary

MED439
KING SAUD UNIVERSITY

MICROBIOLOGY
Team 439

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Color index

- Girls' slides
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Objectives:

- know the global distribution of schistosomiasis
- describe the life cycle of schistosomiasis
- compare relation between chronic schistosomiasis and portal hypertension
- know pathology, diagnosis and treatment of schistosomiasis
- know life cycle of Fasciola hepatica
- know pathology , diagnosis and treatment of Fasciola hepatica
- compare between true infection and sheep liver infected with Fasciola hepatica which lead to false infection

Schistosomiasis

Classification of Parasites

Protozoa	Helminths
○ Unicellular ○ Single cell for all functions	○ Multicellular ○ Specialized cell
1. Amoebae: move by pseudopodia 2. Flagellates: move by flagella 3. Ciliates: move by cilia 4. Apicomplexa (Sporozoa) tissue parasites	1. Round worms (Nematodes): Elongated, cylindrical, unsegmented 2. **Flat worms:** - **Trematodes: leaf-like, unsegmented** - Cestodes: tape-like, segmented

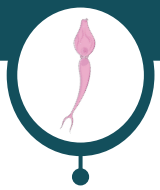
Schistosoma species (Blood Flukes[1])

Girls slides only

- A genus of **trematodes,** commonly known as **blood-flukes,**
- Are parasitic flatworms responsible for a highly significant group of infections in humans termed schistosomiasis also called bilharziasis and snail fever
- Schistosomiasis is considered by the WHO as the second most socioeconomically devastating parasitic disease (after malaria) with hundreds of millions infected worldwide
- Depending on the infecting species, Adult flatworms parasitize **blood capillaries** of either the:
  - **Mesenteries (Schistosoma Mansoni)**
  - **Plexus of the bladder (Schistosoma Haematobium)**

Life Cycle

Briefly



Infective stage:
Cercaria
(it will penetrate the human skin)

Intermediate host[2]:
Snails

Definitive Host:
Human

Diagnostic stage[3]:
Eggs pass in stool or urine

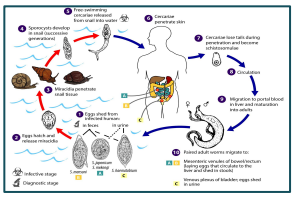
[1]: The very small adult worms live inside the capillaries
[2]: The eggs (diagnostic) are excreted into a canal (ترعة) because it needs soil to grow and then it goes inside a snail for a while then it goes back into the canal as cercaria (infective)
[3]: S. Mansoni eggs are in stool, in case of S. Haematobium, their eggs are found in urine

Life cycle

Life Cycle

Infective stage

Cercaria is the infective stage



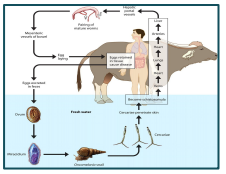
- **Cercaria** emerge from **snail** in the water and **penetrate the skin** of the human. **Causing dermatitis.**
- Cercaria is transformed into a schistosomula inside the host tissues.

The **schistosomula** first enters the systemic circulation then finds its way into:

1. Portal circulation (**S .mansoni** and S. japonicum[1]) 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(**bladder**) and venous plexus.

Diagnostic stage

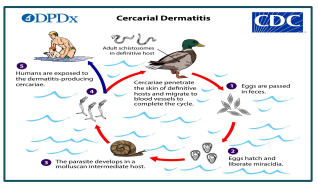
The egg is the diagnostic stage



- Eggs of S.mansoni and S.japonicum[1] are passed mainly in **stool.**
- Eggs of S.haematobium passed mainly in the **urine.**

Schistosome Dermatitis[2]

- 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

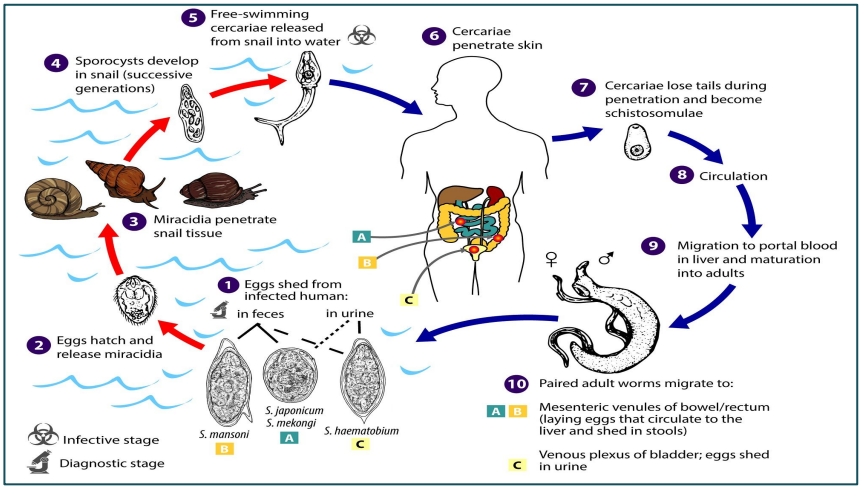


[1]: In Japan, China, Indonesia and the Philippines

[2]: Cercarial dermatitis, is a short-term allergic immune reaction occurring in the skin of humans that have been infected by water-borne schistosomes

Pathogenesis

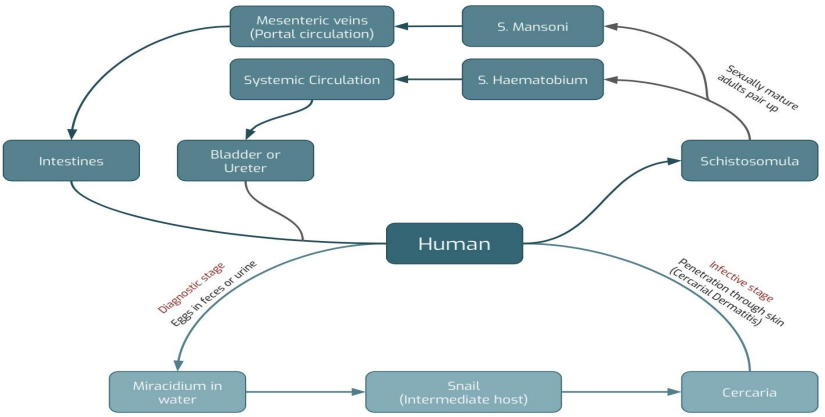
Girls slides only



	S.mansoni & S.japonicum	S.haematobium
Eggs passing	Eggs are **passed with feces** from infected human with S.mansoni & S.japonicum(1-A&B)	Eggs are passed **during micturition** from host infected with S.haematobium (1-C)
Water phase	the **miracidium hatches out of the egg**(2) and searches for a suitable freshwater snail to act as an intermediate host(3). **In the snail the miracidium develops to cercaria**(4). From a single miracidium result a few thousand cercaria, every one of which is capable of infecting a human	
	Cercaria emerge from snail(5) in the water and **penetrate the skin of the human**(6) causing skin dermatitis	
Human phase	The cercaria is transformed into a schistosomula inside the host tissue(7). The schistosomula first **enters the systemic circulation**(8) **and then finds its way into the portal circulation**(9)	
	(S.mansoni & Sjaponicum) **worms mature in the mesenteric veins of the portal circulation**(10-A&B)	S.haematobium worms generally remain in the systemic circulation and **mature in the blood vessels of the vesical (bladder) plexus** (10-C).
Shortly	Someone infected with schistosoma passes eggs in urine/stool → miracidium hatches out of the egg → Finds a snail → Develop into Cercaria → Emerge from the snail → Penetrates the skin → Cause dermatitis → Inside host cells, Becomes schistosomula → Enter systemic circulation → portal circulation→To:	
	it will go to **mesenteric veins of portal circulation**	it will go to vesical plexus (**bladder**)

Summary

Extra



Pathogenicity

Pathogenicity[1]

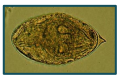
★ **Egg is the main cause of pathology in schistosomiasis.** Many eggs become stranded in the tissues or are carried by the bloodstream to other organs mainly the **LIVER**.

- 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.
- Each mature female lays 300 eggs

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)**

Eggs of Schistosoma mansoni with lateral spine

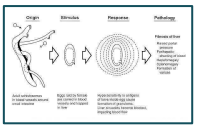


Egg of S.haematobium with terminal spine

Chronic Schistosomiasis

Could cause:

- Portal hypertension
- Hepatomegaly & splenomegaly with ascites



Cercarial Dermatitis[2]

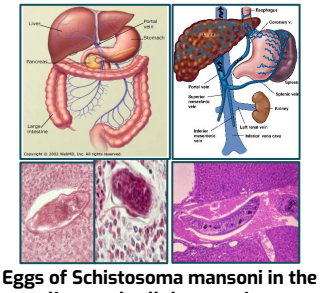
- At the site of entry of cercaria.

Toxic Metabolites

- Liberated during the growth of schistosomula in the circulation veins,
- **May cause:** anaphylactic reaction, fever, urticarial rashes and eosinophilia

Developing Schistosoma in Liver

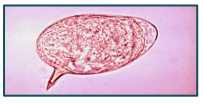
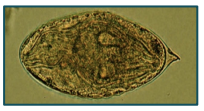
- **S. mansoni** & S. japonicum located mainly in mesenteric vein and its branches, the worm discharges EGGS **(300 eggs)** ,**the eggs travel in 2 directions:**

The Bowel	Some eggs find their way into the lumen of the bowel and appear in the **feces**.
Bloodstream	Other flow with bloodstream in the portal circulation and enter the **LIVER (MAINLY)**. Most of these eggs are trapped in the liver and give rise to pathology as: ○ some of these eggs find their way through the liver tissue and enter the systemic circulation to another organ as brain. ○ fibrosis of the liver caused from eggs settled in the liver. ○ **Portal hypertension** which may lead to: -hepatomegaly -esophageal varices -splenomegaly -hemorrhoids -ascites -And could lead to death  **Eggs of Schistosoma mansoni in the liver and cellular reaction**

[1]: **Pathogenesis** is the mechanism whereby something causes a disease while **pathogenicity** is the the quality of an organism to cause a disease or inflict damage on host

[2]: Cercarial dermatitis, is a short-term allergic immune reaction occurring in the skin of humans that have been infected by water-borne schistosomes

Schistosomiasis

Species:	Schistosoma mansoni	Schistosoma haematobium
Pathology		
Causes	• Intestinal Schistosomiasis	• Urinary Schistosomiasis
Location	• **Mesenteric portal circulation veins**	• **Vesical Venous plexus** surrounding the urinary bladder.
Prepatent period	• 5-7 weeks	• 10-12 weeks
Egg deposition and extrusion	• **Dysentery** (blood and mucus in stools).[2] • Hepatosplenomegaly. • CNS involvement (rare).	• **Painless** hematuria.[1] • Inflammation of bladder and burning micturation. • CNS involvement (rare). • Eggs are trapped in the wall of the bladder where they may give rise to calcification and granuloma formation.
Tissue proliferation and repair	• Periportal fibrosis • hematemesis • Papillomata in the intestine. • Lung and CNS involvement.	• Periportal fibrosis.[3] • Papillomata in the bladder and lower ureter (leading to obstructive uropathy). • Constriction of the ureter may produce hydronephrosis and **cancer of the bladder.** • Lung and CNS involvement.
Diagnosis & Treatment		
Microscopy (main)	**Examination of stool → Eggs with lateral spine in stool** 	**Examination of urine → Eggs with terminal spine in urine** 
Immunology	Serology tests CFT, **ELISA**	
Indirect	• Endoscopy • Radiology	• Cystoscopy • Radiology
Intradermal test	With cercarial antigen cause allergic reaction.	
Treatment	Praziquantel	

[1] differential diagnosis of painless hematuria is malignancy

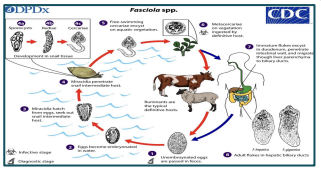
[2] differential diagnosis of dysentery is E.histolytica, shigella and IBD.

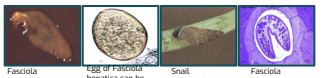
[3] dr.Mona: **delete it** but dr.alkhalifi said it's important

Fasciola Hepatica (Liver fluke)

Transmission[1] and Pathogenesis

- Ingestion of raw, fresh-water vegetation contaminated with metacercaria.
- Metacercaria excyst in the duodenum → migrate through intestinal wall to the liver and settle in the biliary tract → grow into adult worm and liberate eggs in bile → throw bile eggs reach the intestine and then passed in stool





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

Life Cycle

Infective stage: Metacercaria

Intermediate host: Snails

Definitive Host: Human, Goat, Sheep and Cattle

Diagnostic stage: Eggs pass in stool or duodenal aspirate

Clinical picture

False infection[2]

- Occurs when eggs are eaten in infected animal liver and passed in stools.
- 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.

True infection

- Occurs when man ingests water plant (watercress) contaminated with METACERCARIA.
- the adult worm can causes mainly:

1. **Biliary colic with biliary obstruction, jaundice.**
2. Generalised abdominal pain.
3. Cholecystitis and cholithiasis.

Diagnosis

- **Eggs in stools or duodenal aspirate.**
- **Serological test:** CFT and skin test.

Treatment

Dr.Mona:
I don't think we'll ask you about it

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.

[1]: Fecal-oral route not through skin
[2]: When someone eats a raw animal liver that contains Fasciola eggs, it will pass in stool and could result in a false infection (eggs are present but there is no disease), to get a true infection, there must be metacercaria (the infective stage)

Drs' notes

Dr. Mona

- Parasites of nematodes and cestodes usually stay in the intestines. However, the mature parasite of schistosoma (trematodes) stay/swim in the blood vessels thus called blood-flukes.

- Schistosoma transmission has to be through skin penetration (not by fecal-oral route).

- Life cycle:-
  1. Someone infected with schistosoma passes eggs in urine or stool قريب من قنوات مياه راكدة
  2. The passed eggs becomes something called **Miracidium**
  3. Miracidium **escapes the egg** (hatch out), and it **searches for a snail** (قوقعة/حلزون)
  4. In the snail, a single **miracidium** will **develop into** thousands of **Cercaria**
  5. Cercaria emerges from/leaves the snail
  6. It penetrates the skin and cause **dermatitis** (for 2 days)
  7. Inside host cells (after 2 days), it **becomes schistosomula**
  8. Schistosomula **enters systemic circulation**
  9. **Depending on the type**, it will either go from systemic circulation to:
     a. If it was ***S. mansoni***, it will go to portal circulation (mesenteric veins).
     b. If it was ***S. haematobium***, it will go to vesical plexus (bladder).

★ The **main pathology** of Schistosoma is caused by? The **eggs**.
- Some eggs will be passed to the blood again to cause damage (hemorrhage, organ damage, granulomas, fibrosis).
- Other eggs will be passed outside the body through stool or urine to infect other people (for the sake of survival).

- **Possible Qs by dr:**
  - What is the infective stage? Cercaria
  - What is the diagnostic stage? Eggs
  - What is the first disease caused by cercaria? Skin penetration & dermatitis
  - What are the types of schistosoma?
    - Mesenteric *(S.mansoni)* → passes some of the eggs through stool/feces.
    - Vesical *(S.haematobium)* → passes some of the eggs through urine.
  - What is the intermediate host? Snail
  - What is the definitive host? Human

- Schistosomula can cause anaphylactic shock when it circulates in the blood.

- Schistosoma haematobium: usually located in vesical plexus around the bladder. It causes granulomas and painless hematuria. As the granuloma gets bigger, it can cause stricture in the ureter/urethra leading to bladder cancer, obstruction, and kidney damage. Diagnosis is by looking for eggs with terminal spine in the urine.

- Schistosoma mansoni: usually located in mesenteric portal veins. It causes dysentery (blood/mucus in stool) and liver damage (which can lead to periportal fibrosis, portal hypertension, and hepatosplenomegaly). Diagnosis is by looking for eggs with lateral spine in the stool.

- Fasciola Hepatica's cycle:
  1. Human consumes food (خضار/نباتات مائية) that is contaminated with **metacercaria**.
  2. It reaches the intestine → goes to the **bile duct** and becomes adult in there.
  3. Some of its eggs will be excreted in stool.
  - Infective stage? Metacercaria ingested with contaminated grass
  - Diagnostic stage? Eggs in stool
  - Intermediate host? Snail
  - Definitive host? Human and cattle

- In true infection, human eats food that is contaminated with metacercaria itself **not** just the eggs (infective stage) → adult will grow in the bile duct/liver → will suffer manifestation such as **(jaundice, biliary obstruction/colic).**

- In false infection, human eats raw cattle liver that was infected with Fasciola Hepatica. However, it will not cause any liver manifestations, and the eggs will be excreted in stool normally.

Dr. AlKhalifi

- The antigens inside Schistosoma eggs are responsible for the pathology of Schistosoma, and damage is caused by cell mediated reactions.

- First, someone infected with Fasciola Hepatica passes unembryonated eggs in stool. Later on, eggs will become embryonated in the water (Miracidium), and it will hatch out looking for a snail. In the snail and while still swimming in the water, it will develop into cercaria first. Then, when this cercaria **finds a water plant**, it will finally تتحوصل and develop into **metacercaria** and infect other person by ingestion of this contaminated water plant (fecal-oral route).

- Accordingly, we can say that the snail is the first intermediate host of Fasciola Hepatica, and the water plant is the second intermediate host.

Quiz

MCQ

- ★ Q about a patient with portal hypertension, hepatosplenomegaly, periportal fibrosis? S.mansoni
- ★ Q about a patient with bladder cancer & urinary manifestations? S.haematobium
- ★ Q about a patient with biliary obstruction, biliary colic, and jaundice? Fasciola Hepatica

Q1: Infective stage in Schistosomiasis is?

A- Eggs
B- Sporozoites
C- Metacercaria
D- Cercaria

Q2: Which of the following is considered the definitive host of Schistosoma?

A- Humans
B- Snails
C- Sheep
D- Cattle

Q3: Which one of the following organisms can lead to splenomegaly and esophageal varices as a complication

A- Schistosoma Haematobium
B- Schistosoma Mansoni
C- Fasciola Hepatica
D- Leishmania Donovani

Q4: A 46 year-old man came to the ER complaining of painless hematuria and pain around his bladder, clinical examination showed dermatitis, what is the most likely diagnosis?

A- Schistosoma Haematobium
B- Schistosoma Mansoni
C- Fasciola Hepatica
D- Schistosoma Japonicum

Q5: Where does Metacercaria of Fasciola hepatica migrate?

A- Liver
B- Bile
C- kidney
D- Spleen

Q6: What is the diagnostic stage of Schistosoma mansoni?

A- Cyst.
B- Egg in the urine.
C- Eggs in the stool.
D- Embryonated egg.

Answers: Q1:D | Q2:A | Q3:B | Q4:A | Q5:B| Q6:C

SAQ

Case: A 34 year-old patient came to the hospital due to severe itching in her thighs, spleen was palpable on clinical examination, a stool sample under the microscope showed eggs with a lateral spine.

Q1: What is the most likely diagnosis?

Schistosomiasis

Q2: What is the most likely causative agent?

Schistosoma Mansoni

Q3: What is the infective stage in this agent?

Cercaria

Q4: What is the main cause behind the pathology of this agent?

Eggs

Q5: What is the diagnostic stage in this agent?

Eggs in stool

Q6: What is the treatment in this case?

Praziquantel

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