INTERNATIONAL SCHOOL OF MEDICINE

Department of Infectious Diseases

The topic of the lecture:

Schistosomiasis

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Topics

- Definition
- The Pathogen
- Epidemiology
- Etiology and Life Cycle
- Pathobiology
- Clinical manifestations
- Diagnosis
- Treatment

World Health Organization

- Schistosomiasis is an acute and chronic disease caused by parasitic worms.

- People are infected during routine agricultural, domestic, occupational, and recreational activities, which expose them to infested water.

- Lack of hygiene and certain play habits of school-aged children such as swimming or fishing in infested water make them especially vulnerable to infection.

World Health Organization

- Schistosomiasis control focuses on reducing disease through periodic, large-scale population treatment with praziquantel; a more comprehensive approach including potable water, adequate sanitation, and snail control would also reduce transmission.

- Estimates show that at least 206.5 million people required preventive treatment for schistosomiasis in 2016, out of which more than 88 million people were reported to have been treated.

History

- Schistosomiasis is known as bilharzia or bilharziosis in many countries, after German physician **Theodor Bilharz**, who first described the cause of urinary schistosomiasis in 1851.
- The first doctor who described the entire disease cycle was **Piraja da Silva** in 1908.
- It was a common cause of death **for Ancient Egyptians** in the Greco-Roman Period.

The pathogen

- Schistosomiasis is one of the most important parasitic diseases of humans and is a global public health problem in the **developing world**.

Schistosomiasis is caused by blood flukes (trematode worms) of the genus *Schistosoma*.

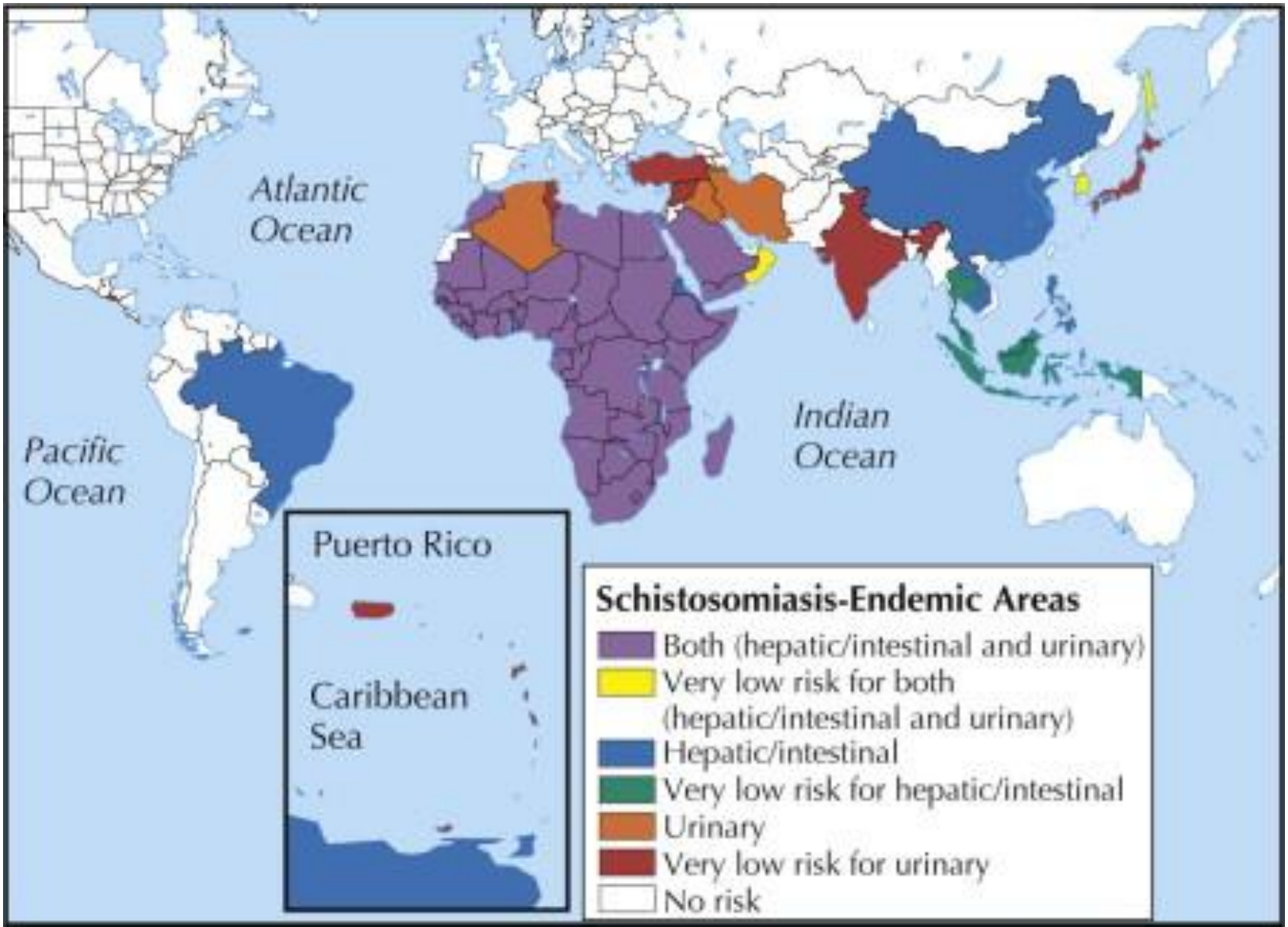
The Pathogen

- The large male (0.6 to 2.2 cm × 2 to 4 mm) has a ventral gynecophoric canal in which the female (1.2 to 2.6 cm × 1 to 2 mm) is held during **copulation**.

The pathogen

Species		Geographical distribution
Intestinal schistosomiasis	*Schistosoma mansoni*	Africa, the Middle East, the Caribbean, Brazil, Venezuela and Suriname
	Schistosoma japonicum	China, Indonesia, the Philippines
	Schistosoma mekongi	Several districts of Cambodia and the Lao People's Democratic Republic
	Schistosoma guineensis and related *S. intercalatum*	Rain forest areas of central Africa
Urogenital schistosomiasis	*Schistosoma haematobium*	Africa, the Middle East, Corsica (France)

Distribution



EPIDEMIOLOGY

- Infection sources
- Mode of transmission
- Susceptible population

Infection sources

- Patients

- reservoir host – **animal reservoirs**

  cows, pigs(S. japonicum)

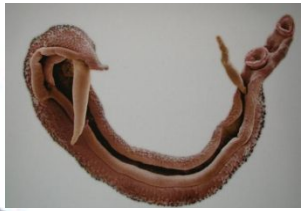
  Rodents, monkeys, and baboons have been found infected in nature, but the role of these animals as reservoirs **does not seem** to be epidemiologically important.

- The **freshwater snail intermediate hosts** are Biomphalaria spp in Africa and Biomphalaria glabrata (Australorbis) and Tropicarbis in South America and the West Indies.

Transmission

- People become infected when larval forms of the parasite – released by freshwater snails – penetrate the skin during contact with infested water.
- Transmission occurs when people suffering from schistosomiasis contaminate freshwater sources with their excreta containing parasite eggs, which hatch in water.

Schistosoma life cycle



6 weeks

Adult worms in human vesical or mesenteric veins

5 to 9 weeks

Schistosomula first parasite stage in humans

Egg in urine or stools

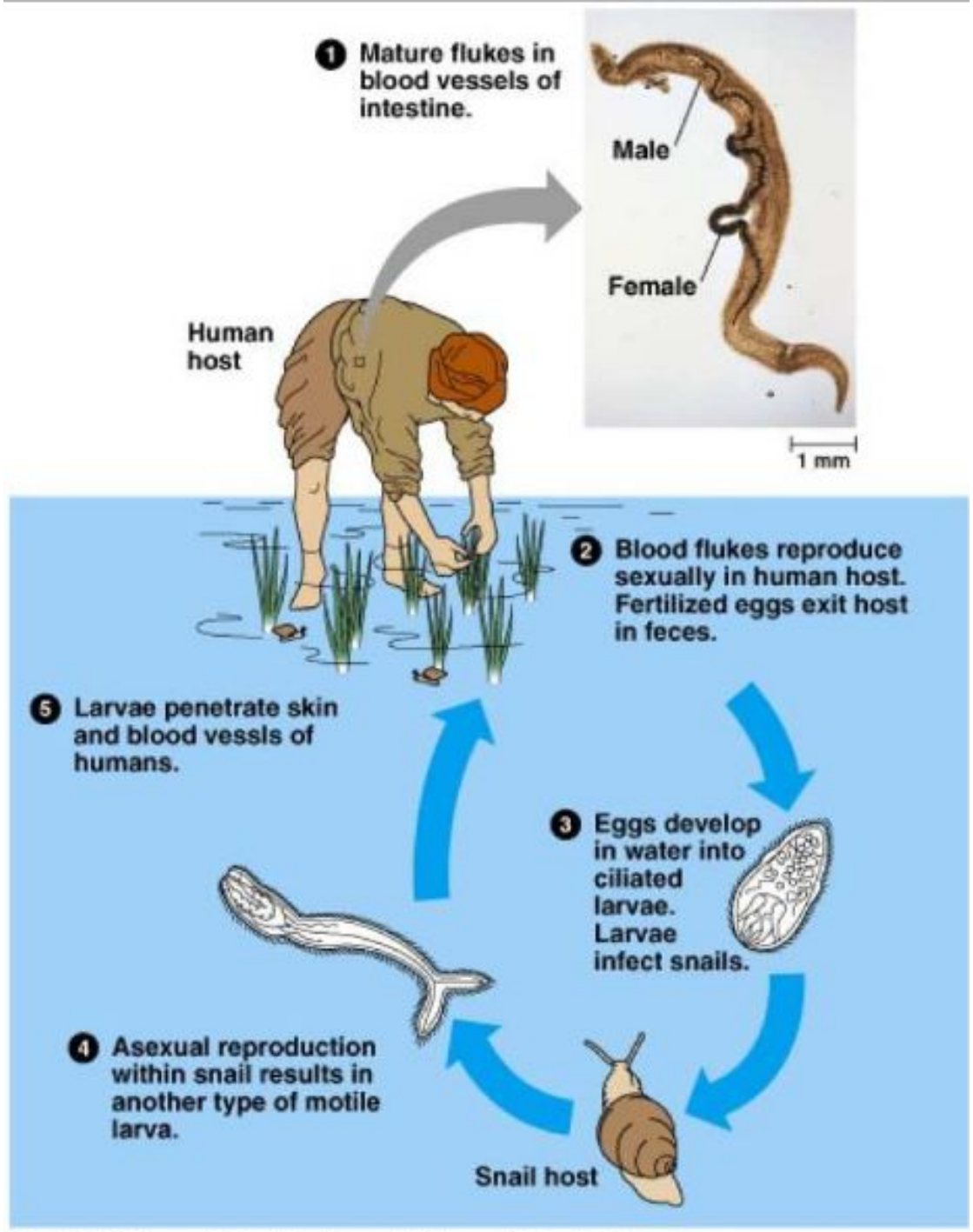
72 hours

Cercaria free-living in fresh water (infective stage)

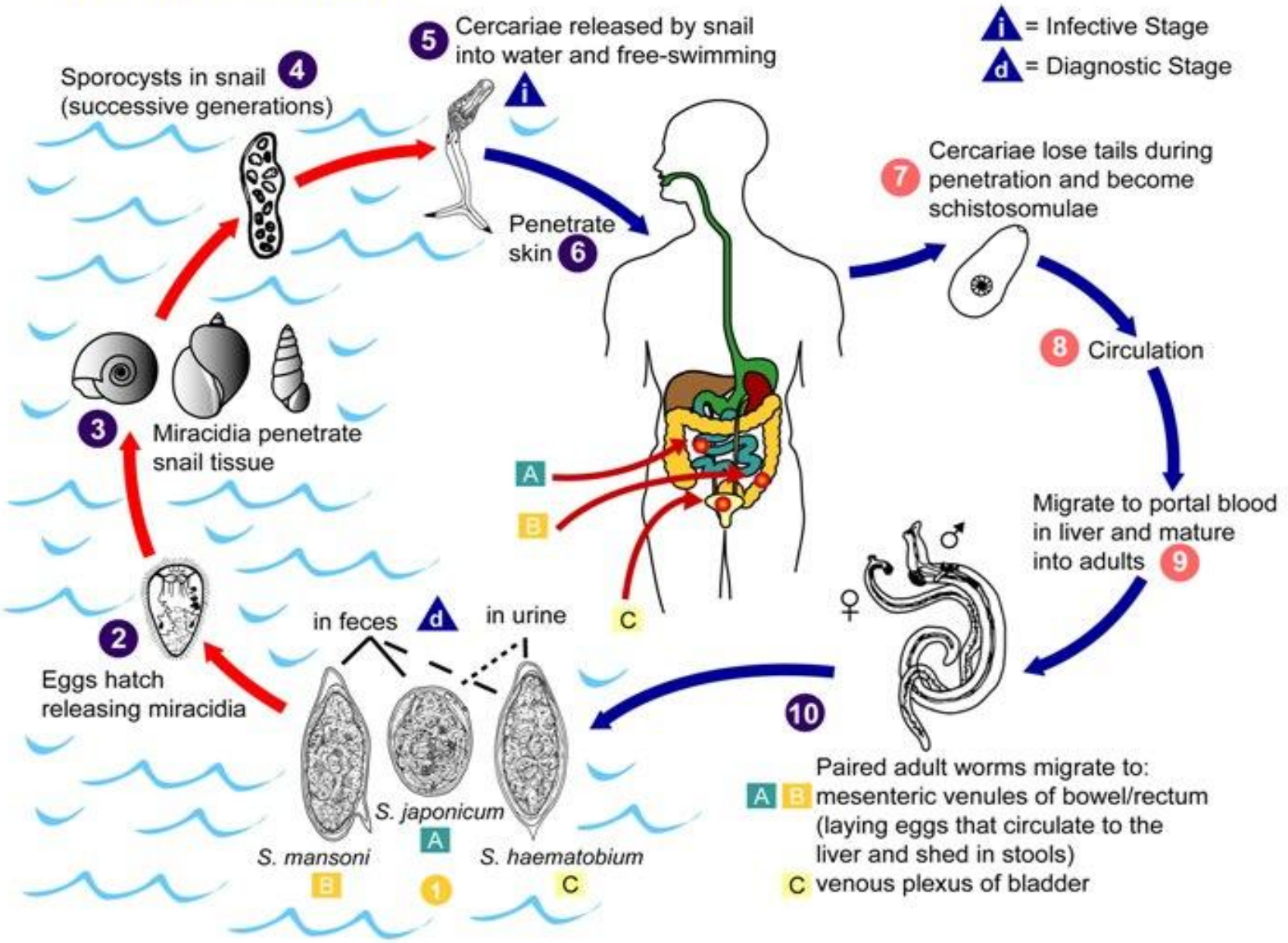
Miracidium free-living in fresh water

Freshwater snail asexual multiplication

4 to 7 weeks



Schistosomiasis



PATHOPHYSIOLOGY

- Adult worms release eggs in the venules of the mesentery, and the eggs enter the liver through the portal vein, where they become lodged in the terminal branches of the portal venules.

- The lodged eggs cause a granulomatous inflammation, and the lesions are healed by periportal fibrosis.

- *S. japonicum* is more virulent than S. mansoni because its infection produces ten times more eggs.

PATHOPHYSIOLOGY

- Because the **habitat** of S. mansoni, S. japonicum, S. mekongi, and S. intercalatum **worms is the mesenteric blood vessels**, the intestines are involved primarily, and **egg embolism results in secondary involvement of the liver**.
- In the liver, the **granulomas** result in perisinusoidal obstruction of portal blood flow, **portal hypertension**, splenomegaly, esophageal varices, and portosystemic collateral circulation.
- Liver cell perfusion is not reduced; consequently, liver function test results remain normal for a long time.

CLINICAL MANIFESTATIONS

- **Clinical manifestations of schistosomiasis are divided into**
- **-schistosome dermatitis**
- **-acute schistosomiasis**
- **-chronic schistosomiasis**

CLINICAL MANIFESTATIONS

- A **pruritic papular rash** occurs **within 24 hours** after the penetration of cercariae and reaches **maximal intensity in 2 to 3 days**.

CLINICAL MANIFESTATIONS
(Acute schistosomiasis)

- **Acute** schistosomiasis occurs usually **20 to 50 days** after primary exposure.

- The clinical syndrome (i.e., **fever, chills, liver and spleen enlargement, and marked eosinophilia**) originally described for ***S. japonicum*** infection, and still common for this species, is increasingly being diagnosed in Brazil in individuals with S. mansoni infection.

CLINICAL MANIFESTATIONS
(Acute schistosomiasis)

- **Malaise, diarrhea, weight loss, cough, dyspnea, chest pain, restrictive respiratory insufficiency and pericarditis** are important **findings in this phase.**

CLINICAL MANIFESTATIONS
(Acute schistosomiasis)

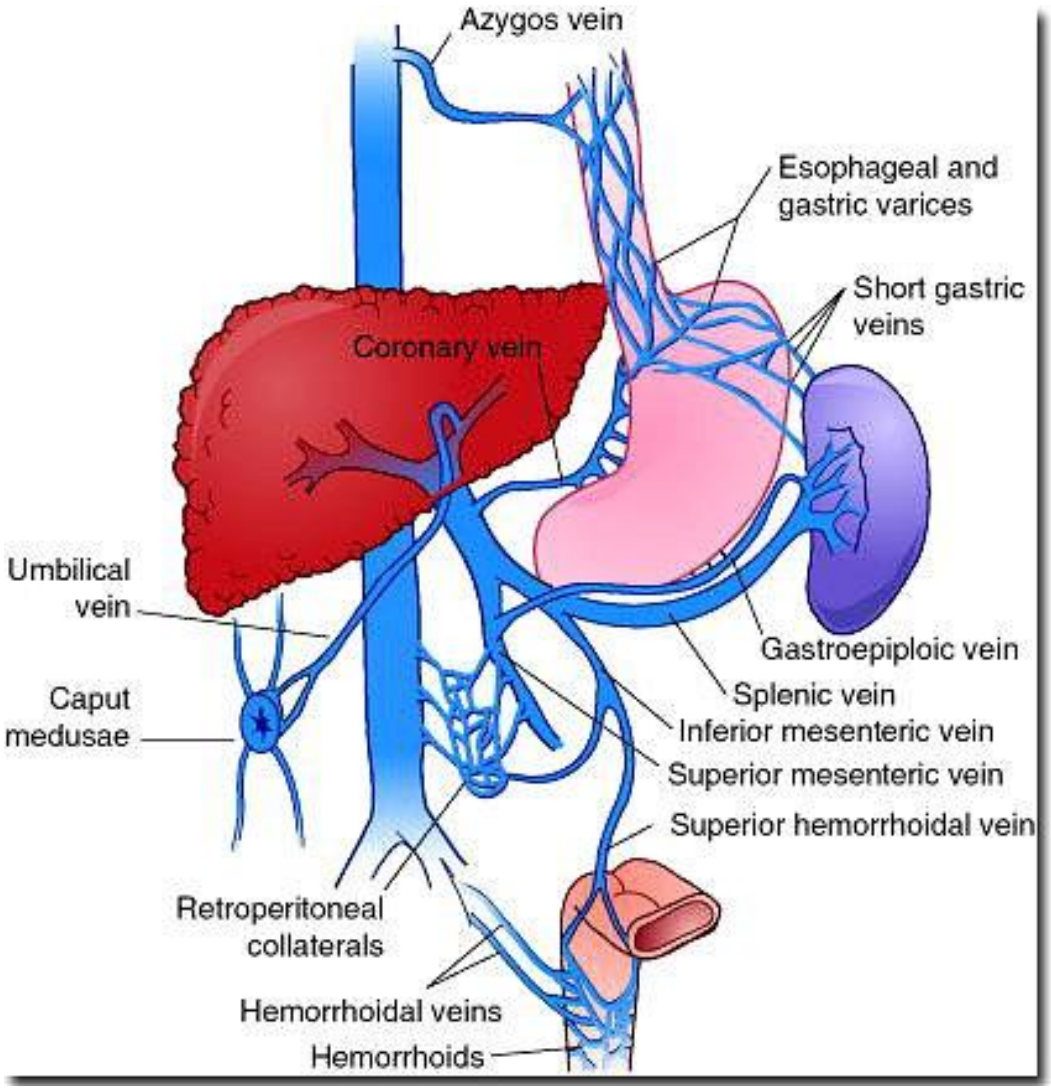
- Acute disease is **not** observed in individuals living in **endemic areas** of schistosomiasis because of the downmodulation of the immune response by antigens or idiotypes transferred from mother to child.
- Acute schistosomiasis is becoming a frequent and major clinical problem in **nonimmune individuals** from **urban regions** who are exposed for the first time to a heavy infection in an endemic area.

CLINICAL MANIFESTATIONS (chronic schistosomiasis)

- **Abdominal pain, irregular bowel movements and blood in the stool are the main symptoms of intestinal involvement.**

CLINICAL MANIFESTATIONS

- Patients may remain asymptomatic until the manifestation of **hepatic fibrosis** and **portal hypertension develops**.



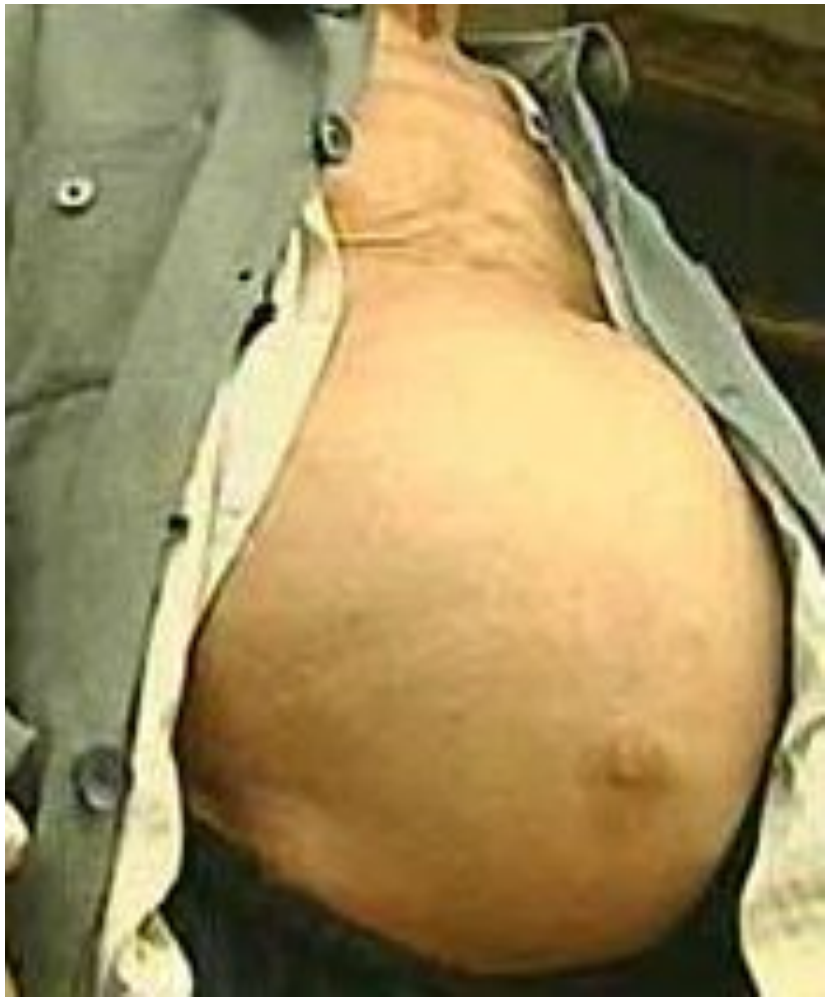
CLINICAL MANIFESTATIONS

- Hepatic fibrosis is **caused by** a granulomatous reaction to Schistosoma **eggs** that have been carried to the liver.

- Hematemesis from **bleeding** esophageal or gastric varices may occur. In such cases, anemia and decreasing levels of serum albumin are observed.

CLINICAL MANIFESTATIONS

- **Portal hypertension:** severe hepatosplenic disease with decompensated liver disease. **Jaundice**, **ascites**, and **liver failure** are then observed.



CLINICAL MANIFESTATIONS

- In hospitalized adult patients with ***S. japonicum*** infection, **cerebral** schistosomiasis occurs in **1.7 to 4.3%.**
- It may occur as early as **6 weeks** after infection.

CLINICAL MANIFESTATIONS

- In ***S. haematobium*** infection, the main organ system involved is the **urinary tract**.

- The acute granulomatous response to parasite eggs in the early stages causes urinary tract disease, such as urethral ulceration and bladder polyposis.

CLINICAL MANIFESTATIONS

- In chronic disease, usually in older patients, granulomas at the lower end of the ureters obstruct urinary flow and may cause hydroureter and hydronephrosis.

- Bladder fibrosis and calcification are also seen in this phase. Up to 70% of infected individuals have hematuria, dysuria, or urinary frequency.

CLINICAL MANIFESTATIONS

- An increased incidence of squamous cell **carcinoma** of the bladder has been reported in endemic areas of S. haematobium infection, but the mechanism of carcinogenesis is unknown.

- S. haematobium eggs have occasionally been found in the lungs, with subsequent focal pulmonary arteritis and pulmonary hypertension.

Basis for DIAGNOSIS

- History of epidemiology: infested water contanct
- Clinical manifestation
- Laboratory tests
- Differentiation diagnosis

DIAGNOSIS

- Blood routine examination
- Liver function test
- Liver ultrasonic
- CT
- Antibodies detection: Several **serologic tests** for detection of IgM, IgG, and IgA antibodies to Schistosoma antigens are available.
- Examination of feces-the eggs
- Rectum tissue biopsy

DIAGNOSIS

- Schistosomiasis is diagnosed through the detection of parasite eggs in stool or urine specimens.
- Antibodies and/or antigens detected in blood or urine samples are also indications of infection.

DIAGNOSIS

- For urogenital schistosomiasis, a filtration technique using nylon, paper or polycarbonate filters is the standard diagnostic technique. Children with *S. haematobium* almost always have microscopic blood in their urine which can be detected by chemical reagent strips.
- The eggs of intestinal schistosomiasis can be detected in faecal specimens through a technique using methylene blue-stained cellophane soaked in glycerine or glass slides, known as the Kato-Katz technique.

TREATMENT

- **Three** compounds are in use **metrifonate**, **oxamniquine**, and **praziquantel**, and all three are included in the World Health Organization's list of essential drugs.

Praziquantel

A pyrazinoisoquinoline derivative, is the drug of choice for the treatment of schistosomiasis for **four** reasons:

- high efficacy against all schistosome species and against cestodes,
- lack of serious short-term and long-term side effects,
- administration as a single oral dose
- competitive cost is cheap.

TREATMENT

- The **standard recommended treatment** consists of a single dose of praziquantel, **40 mg/kg**, for ***S. mansoni***, ***S. haematobium*** and ***S. intercalatum*** infection.
- In ***S.japonicum*** infection, a total dose of **60 mg /kg** is recommended, split into two or three do ses in a single day.
- ***S. mekongi*** may require **two** treatments at **60 mg /kg** body weight.

TREATMENT

With these dosages of praziquantel, recorded cure rates are:

- 75 to 85% for S.haematobium,
- 63 to 85% for S. mansoni,
- **80 to 90%** for ***S. japonicum***,
- 89% for S.intercalatum,
- 60 to 80% for double infections

with S. mansoni and S. haematobium.

TREATMENT

- The most common **side effects** observed with praziquantel or oxamniquine are related to the g astrointestinal tract: **abdominal pain** or **discomf ort**, **nausea**, **vomiting**, **anorexia**, and **diarrhea.**

TREATMENT

- These symptoms can be observed in up to 50% of patients but are usually **well tolerated**.

- Other side effects are related to the central nerv ous system (e.g., headache, dizziness, drowsiness) an

TREATMENT

Although a reduction in the intensity of infection and morbidity has been documented after **mass chemotherapy**, provision of clean **water**, use of **molluscicides** (kill the snail), and adequate sanitation should also be

TREATMENT

- The mortality rate is **0.05%** for severe S. mansoni in
- **Bleeding** from esophageal varices is the **most serious complication**.
- Chronic infection can lead to hepatocellular carcinoma.

Summary of schistosomiasis (1)

- Schistosomiasis occurs mainly in **rural agricultural** and **periurban areas** in the **developing world**.
- **Five major species** of Schistosoma affect humans.
- The **intermediate hosts** is **snail.**
- **Eggs,** causing **the portal hypertension and liver fibrosis,** is very important in pathobiology and diagnosis.

Summary of schistosomiasis(2)

- **Metrifonate**, **oxamniquine**, and **praziquantel** are included in the WHO's list of essential drugs.
- **Praziquantel** is well tolerated and effective for **different clinical forms** of schistosomiasis.