Schistosoma

A Trematode Platyhelminth that causes schistosomiasis, also known as bilharzia.

Trematodes are usually oval flattened leaf shaped organisms with two suckers and sometimes spines on the surface, have a blind ending gastrointestinal tract and they are hermaphrodites, their eggs are large and operculated.

They require an intermediate which is an organism from the phylum Mollusca such as the freshwater snail which is the intermediate host of Schistosoma.

Schistosoma is an oddity among trematodes as it has separate sexes and it's rounded not leaf shaped.

The female Schistosoma even looks more similar to nematodes than other Platyhelminthes.

The male is more flattened than the female but not as flat as other trematodes, it's elongated and has a groove for the female Schistosoma to lie in and remain there for the rest of its life.

Its life span is 5-10 years but can reach up to 30 years.

Its gastrointestinal tract is similar to other Platyhelminthes, a bifurcating blind ended tract and it has a spine.

There are three species of Schistosoma that affect humans:

-Schistosoma haematobium which resides in the urinary tract.

-Schistosoma mansoni which resides in the large intestine.

-Schistosoma japonicum which resides in the small intestine.

The egg of Schistosoma is also peculiar as it is large and does not have an operculum, it has a spine on its surface which is a characteristic of each species

The spine of Schistosoma haematobium egg is terminal.

The spine of Schistosoma mansoni egg is lateral.

Schistosoma japonicum egg is small and rounded and has a small lateral rudimentary spine.

Life cycle of Schistosoma

The eggs have to pass into water to reach the freshwater snail either through urine for haematobium or through faeces for mansoni and japonicum.

Other trematodes that reside in the lungs such as Paragonimus westermani have its eggs passed through sputum.

In the water, the egg disintegrates releasing the miracidia which is ciliated to be able to swim and has a pointed anterior end which allows it to penetrate through the skin of the mollusc.

Inside the mollusc it develops into a ball of cells called a sporocyst which will divide inside to give rise to daughter sporocysts, the germ cells within the daughter sporocysts give rise to the cercariae.

The cercariae looks like a rudimentary worm, shaped like an arrow with a gastrointestinal tract, an oral and a ventral suckers, a tail and a bullet shaped end.

The cercariae leaves the snail and swim in the water until they find someone swimming, bathing...etc. in the water and penetrate his skin by their bullet ends and digestive enzymes to enter the subcutaneous tissue.

As they enter the skin, the cercariae lose their tail as it's no longer needed then they develop into small Schistosomula.

After being in the subcutaneous tissue, they go into the lymph vessels then to the venous circulation, schistosomula go along the circulation to the lungs then to the liver where they develop into male and female trophozoites (adult worms) which are 1-2.5 cm in length, then the male and female worms pair in the liver, this is called the acute stage.

After that the trophozoites go retrogradely against venous blood flow to settle in the post capillary venules of their target organ depending on the species and cannot go further into the capillaries as they are too small.

Mansoni and japonicum reach the intestine easily from the liver through the portal vein while haematobium reaches the urinary tract venules through the portosystemic anastomosis.

They live in the venules and begin to produce eggs, this is called the chronic stage.

The trophozoites in the post capillary venules don't evoke any immune reaction as they camouflage themselves with human antigens and such as ABO antigens and MHC molecules, they are able to live there for 30 years, but they do cause an immune reaction when they die as they lose their camouflage.

The eggs spines will allow them to stick to the walls of the blood vessels and penetrate their wall and the wall of the organs they supply , reaching their lumen to be able to leave the body through urine and faeces to complete their life cycle.

Unlike the trophozoites, the eggs are not immunologically silent. While they are lodged in the walls of vessels and organs they elicit an allergic reaction to the antigens of the eggs. The allergic reaction is the delayed type 4 hypersensitivity reaction, which is responsible for the tissue damage unlike other organisms that cause tissue damage by releasing enzymes and toxins, the hypersensitivity reaction will activate lots of macrophages that cause granulomas formation that will lead to fibrosis.

The inflammation caused by the hypersensitivity reaction facilitates the eggs passage into the lumen of the organ.

If the human micturates or defecates in the water the cycle begins anew.

Symptoms

The symptoms for Schistosoma mansoni and japonicum are related to the intestines such as abdominal pain, diarrhoea and blood in the stool.

While the symptoms for haematobium are related to the bladder such as Dysuria, frequent micturition and haematuria.
the haematuria can be uniform but is usually terminal which means that the blood will go out at the end of micturition when the wall of the bladder is maximally contracted as it will squeeze the lesioned tissue forcing blood from it to pass into the urine.

Another symptom is the remaining of residual urine in the bladder at the end of micturition, this occurs due to the fibrosis that destroyed parts of the bladder's muscular wall which will not be able to void urine as efficiently as a healthy bladder and this residual urine may predispose to urinary tract infections.

Chronic Schistosoma haematobium infection can predispose to bladder cancer.

Other structures proximal to the bladder may be involved such as the prostate and the seminal vesicle, also ulcerations in the scrotum, the penis, the vulva and the cervix might occur.
The ureters can be also involved in the fibrosis constricting them and causing hydronephrosis.

Some of the eggs do not stick to post capillary venules and are swept with the circulation to end up in the liver causing periportal fibrosis, which will constrict the blood flow to the liver from the portal vein and will lead to portal hypertension. The hepatocytes are intact as this a periportal fibrosis not liver cirrhosis.

Portal hypertension will lead to force opening of the portosystemic anastomoses causing oesophageal varices that may bleed which can be fatal.
Also it can cause portosystemic shunting of the blood.
As the blood coming from the gastrointestinal tract goes directly into the systemic circulation through the anastomoses without passing through the liver which is essential for detoxification, so the blood will carry toxic materials that will cause neurological symptoms such as tremors.

Schistosoma haematobium can go to the lungs and cause fibrosis which will lead to pulmonary hypertension and corpumonale, this can also occur with mansoni and japonicum through shunting.

CNS involvement can occur especially with japonicum as it produces large amounts of small eggs, 10 times the number of eggs produced by haematobium and mansoni hence, this makes it easier for japonicum to cause encephalopathy.

The first symptoms that occur is itching when the cercariae enters through the skin, the itching may last for a day or two then it disappears and it's called swimmer's itch.

Schistosoma mansoni attack the spinal cord and causes transverse myelitis.

The acute stage (when the schistosomula are in the liver) is usually asymptomatic but a disease called katayama fever can occur with japonicum infections, katayama fever has general vague symptoms such as fever, malaise, headache, nausea,vomiting and abdominal pain.

Fever is not a common manifestation of parasitic diseases, other parasites that can cause fever are malaria, trichinella spiralis and amoeba.

Schistosoma that infect birds and animals can penetrate the skin of humans, this causes itching that disappears later, this is called Schistosoma dermatitis and it is not the same as swimmers itch since the human will not have schistosomiasis because these Schistosoma cannot go further than the skin.

Diagnosis is done by examining the urine or faeces depending on the species for the presence of its eggs.

Serology can be used but can produce false positive results as other types of Schistosoma that infect animal may have previously infected the body.

Trichomonus vaginlis

Is a large flagellated protozoan with 3 to 5 anterior flagella, an undulating membrane and an axostyle which is a microtubule system that extends throughout the body of the trophozoite and can stick out of the posterior end or it be associated with flagella.

The axostyle gives rigidity to the trophozoite and contributes to its movement and may help in anchoring it to the wall of the lumen which it is present in.

Trichomonus is very motile and can be identified easily in a fresh specimen.

Usually protozoan trophozoites are very fragile and die quickly outside the body which makes them require a cyst to be transmitted from one host to another as they don’t have an intermediate host.

Unlike other protozoa, trichomonus vaginlis has a hard tough trophozoite and doesn’t require a cyst as the trophozoite itself can spread between hosts.

Apart from being hard, the fact that it is a sexually transmitted disease makes its transmission easier since it doesn’t need to leave human bodies and be exposed to the external environment.

However it’s not strictly sexually transmitted as it can spread by other means such as contact or sharing towels unlike other organisms that cause STDs.

They reside in the vagina hence its name or the urethra in the male.

The infection is usually asymptomatic which helps it spread, but can cause irritation, urethritis or prostatitis in males but this is rare.

In females it can cause hyperaemia, itching, pruritus, excessive yellow frothy secretions and discharges due to the inflammation of the vagina but again it’s usually asymptomatic.

The infection can only go as far as the cervix so there is no risk of complications such as sterility.
Diagnosis is done by examination of the vaginal or urethral discharges for the presence of the motile trophozoites in the fresh specimens.

Treatment is by flagyl (metronidazole) which is the drug of choice.