DIPHYLLOBOTHRIUM LATUM

History and Distribution

This pseudophyllidean tapeworm, formerly called Dibothriocephalus latusis commonly

known as the fish tapewormor the broad tapeworm(Greek diphyllobothrium-having

two leaf-like grooves; dibothriocephalus—having two grooves in the head; —latus

broad). Infection with this tapeworm is called diphyllobothriasis. The head of the worm

was found by Bonnet as early as 1777 but it was only in 1917 that its life cycle was

worked out by Janicki and Rosen. Diphyllobothriasis occurs in central and northern

Europe, particularly in the Scandinavian countries. It is also found in Siberia, ,Japan

.North America and Central Africa. It has not been reported from India

Morphology and Life Cycle

Humans are the optimal definitive host, though dogs, cats and their wild relatives

,may also act as definitive hosts. The adult worm is found in the small intestine

usually in the ileum, where it lies folded in several loops, in contact with the .mucosa

It is ivory-coloured and very long, measuring upto 10 metres or more. The scolex

head) is spatulateor spoon-shaped, about 2 to 3 mm long and 1 mm broad. It) carries

two slit-like longitudinal sucking grooves (bothria), one dorsal and the other ventral.

Immediately behind the scolex is the thin unsegmented neck region, several times longer than the head. The proglottides (commonly, though inaccurately called segments) extend from the neck posteriorly, the youngest being next to the neck and the oldest hindmost. The strobila may have 3000 or more proglottides, consisting of immature, mature and gravid segments in that order from the front backwards.

The mature proglottid is broader than long, about 2 to 4 mm long and 10 to 20 mm broad and is practically filled with male and female reproductive organs. The testes are represented by numerous minute follicles situated laterally in the dorsal plane.

The female reproductive organs are arranged along the midline, lying ventrally. The ovary is bilobed. The large uterus lies convoluted in the centre. Three genital openings are present ventrally along the midline—the openings of the vas deferens, vagina and uterus in that order, from front backwards. The fertilized ova develop in the uterus and are discharged periodically through the uterine pore. D. latumis a prolific egg layer and a single worm may pass about

a million eggs a day. The terminal segments become dried up after delivering many

.(eggs and are discharged in strands of varying length (Fig. 10.2

The eggs are passed in faeces in large numbers. They are broadly ovoid, about

µm by 45 µm, with a thick, light brown shell. It has an operculum at one end ٦٥

and often a small knob at the other. The eggs do not float in saturated salt .solution

.(They are not infective to humans (Fig. 10.3

FIGURE 10.2: D. latum proglottide

FIGURE 10.3: D. latum egg

.FIGURE 10.4: Diphyllobothrium latum. Morphology of body parts

Adult worm showing spatulate scolex, neck and strobila. 2. Scolex .١

showing slit-like sucking grooves. 3. Operculated egg. 4. Mature

proglottid showing male and female reproductive structures

The freshly passed egg contains an immature embryo surrounded by yolk .granules

The eggs are resistant to chemicals but are killed by drying. The embryo with six

hooklets (hexacanth embryo) inside the egg is called the oncosphere. In water it

matures in about 10 to 15 days and emerges through the operculum as the ciliated

first stage larva, called coracidium, which swims about. It can survive in water for

about 12 hours, by which time it should be ingested by the fresh water copepod

cyclops, which is the first intermediate host. In the midgut of the cyclops, the coracidium

casts off its ciliated coat and by means of its six hooklets, penetrates into the

haemocoele (body cavity). In about 3 weeks, it becomes transformed into the elongated

second stage larva about 550 µm long, which is called the procercoidlarva. It has

a rounded caudal appendage (cercomer) which bears the now useless hooklets. If

the infected cyclops is now devoured by a freshwater fish (which is the second

intermediate host), the procercoid larva penetrates the intestine of the fish and .grows

It looses its caudal appendage and develops into the third stage larva called the

FIGURE 10.5: Life cycle of Diphyllobothrium latum. 1. Adult worm in human small .intestine

Operculated egg passed in stools reaches water. 3. Ciliated embryo coracidum .٢ develops

in egg and escapes out into water to be ingested by. 4. Cyclops, the first intermediate

host. 5. The hexacanth embryo sheds its cilia and the oncosphere penetrates the gut

wall of cyclops to develop into the elongated, 6 Procercoid larva. 7. The cyclops containing

procercoid larva is ingested by the second intermediate host, fish in which, 8. The

plerocercoid larva develops. 9. When fish flesh containing the plerocercoid larva is ,eaten

humans become infected

plerocercoidlarva or sparganum. This is a glistening white flattened unsegmented

vermicule, with a wrinkled surface, about 1 to 2 cm long and with a rudimentary

scolex. This is the infective stage for humans. When fish containing plerocercoid

larva is eaten uncooked or undercooked, the larva develops into the adult worm

in the small intestine. The worm attains maturity in about 5 to 6 weeks and starts .(laying eggs. The worm may live for about 10 years or more (Fig. 10.5

Pathogenicity

,The pathogenic effects of diphyllobothriasis depend on the mass of the worm absorption of its byproducts by the host and deprivation of the host's essential metabolic intermediates. In some persons, infection may be entirely ,asymptomatic while in others there may be evidence of mechanical obstruction. Patients may be frightened by noticing the strands of proglottides passed in their faeces. Abdominal discomfort, diarrhoea, nausea and anaemia are the usual manifestations. A kind of pernicious anaemia sometimes caused by the infection is called bothriocephalus anaemia. This is believed to be racially determined, being common in Finland and .rare elsewhere

Epidemiology

The prevalence of the disease depends on the presence of infected human or animal definitive hosts, suitable intermediate hosts and the extent of faecal pollution of ,natural fresh waters by the definitive hosts. Though dogs, cats, foxes, jackals mongoose, pigs and many wild animals may be naturally infected, human cases are primarily responsible for the propagation of the infection. Human cases depend on traditional food habits. Where uncooked, undercooked or inadequately processed

fish or fish products are eaten, infection is likely to be present. In countries like .India, where fish is eaten only after cooking, the infection does not occur

Diagnosis

Eggs are passed in very large number in faeces, and therefore their demonstration offers an easy method of diagnosis. The proglottides passed in faeces can be .identified by their morphology

Treatment

Praziquantel in a single dose of 10 mg/kg is effective. Niclosamide has also been .used

Prophylaxis

Infection can be prevented by proper cooking of fish, prevention of fecal pollution .of natural waters and periodical deworming of pet dogs and cats

SPARGANOSIS

The term sparganosis is used for ectopic infection by sparganum (plerocercoid (larva

of miscellaneous pseudophyllidean tapeworms, found in abnormal hosts. Human ,sparganosis may result from ingestion of cyclops containing procercoid larva ingestion of plerocercoid larva present in uncooked meat of animals or birds, or local application of raw flesh of infected animals on skin or mucosa. The last method follows the practice prevalent among the Chinese, of applying split frogs on skin .or eye sores

In most cases, the species of tapeworm cannot be identified. The two species often recognised have been Spirometra mansoniand S. proliferum. The sparganum is

usually found in the subcutaneous tissues in various parts of the body, but may also present in the peritoneum, abdominal viscera or brain. Diagnosis is usually .possible only after surgical removal of the worm

Sparganosis has been reported mostly from Japan and South East Asia, less often from America and Australia. A few cases have been reported from India .also

CYCLOPHYLLIDEAN TAPEWORMS

TAENIA SAGINATA

History and Distribution

Commonly called the beef tapeworm, Taenia saginatahas been known as an intestinal parasite of man from very ancient times. But it was only in 1782 the Goeze differentiated it from the pork tapeworm T. solium. Its life cycle was elucidated when Leuckart in 1861 first experimentally demonstrated that cattle serve as the intermediate .host for the worm

The name taeniais derived from the Greek word meaning tape or band. It was originally used to refer to most tapeworms, but is now restricted to the members .of the Genus Taenia

T. saginatais worldwide in distribution, but the infection is not found in vegetarians .and those who do not eat beef

Morphology and Life Cycle

The adult worm lives in the human small intestine, commonly in the jejunum with

its head embedded in the mucosa. The worm is an opalescent white in colour. It is usually about 5 metres in length, but may on occasion be much longer, about 25 .metres or more, thus being the largest helminth causing human infection

The scolex (head) is about 1-2 mm in diameter, quadrate in cross section, bearing hemispherical suckers situated at its four angles. They may be pigmented. The ٤ scolex has no rostellum or hooklets (which are present in T. solium). T. saginatais therefore called the unarmed tapeworm. The suckers serve as the sole organs for .attachment

The neck is long and narrow. The strobila (trunk) consists of 1000 to 2000 proglottides or segments—immature, mature and gravid in that order from front .backwards

The gravid segments are nearly four times as long as they are broad, about mm long and 5 mm broad. The segment contains male and female ٢٠ reproductive structures. The testes are numerous, 300 to 400 (twice as many as in T. solium. The gravid segment has 15 to 30 lateral branches (as against 7 to 13 in T. solium). It differs from T. soliumalso in having a prominent vaginal sphincter and in lacking the accessory ovarian lobe. The common genital pore opens on the lateral wall of the .(segments (Fig. 10.6A

The gravid segments break away and

are expelled singly, actively forcing their

way out through the anal sphincter. As there

is no uterine opening, the eggs escape from

the uterus through its ruptured wall. The

eggs cannot be differentiated from those

FIGURE 10.6A:Scolex of T. saginata with

suckers and no hook ٤

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FIGURE 10.6B: Life cycle of Taenia saginata. 1. Adult worm in human small .intestine. A. Scolex and neck

B. Immature segments. C. Mature segments, showing genital pore opening laterally irregularly alternating between

right and left. D. Gravid segments. 2. Scolex bearing four suckers. No rostellum or hooks. 3. Mature segment

much longer than broad. Uterus has several branches (15-30). 4. Immature egg with hyaline embryonic

membrane around it. 5. Mature egg deposited in soil, ingested by cattle. 6. Oncosphere penetrates intestinal

wall. 7. Cysticercus bovis develops in muscle—measly beef—the infective stage for man

of other species of Taenia, Multiceps or Echinococcus. The spherical eggs measure

to 40 µm in diameter. When freshly released from the proglottid, the egg has ٣٠

a thin hyaline embryonic membrane around it, which soon disappears. The thick

outer wall is radially striated and is brown due to bile staining. In the centre is

a fully developed embryo with three pairs of hooklets (hexacanth embryo). The eggs

do not float in saturated salt solution. T. saginatais a prolific egg producer, with

.a daily output of about 50,000 eggs for 10 years or more

The eggs deposited in soil remain viable for several weeks. They are infective

to cattle which ingest the eggs while grazing. When ingested by cattle (cows or

buffaloes), the egg-shell ruptures and the oncosphere hatches out in the .duodenum

The oncospheres, with their hooklets penetrate the intestinal wall, reach the mesenteric

venules or lymphatics and enter the systemic circulation. They get filtered out in

the striated muscles, particularly in the muscles of the tongue, neck, shoulder, ham

and in the myocardium. In these sites, the oncospheres lose their hooks and in about

to 70 days develop into the mature larva, the bladder wormor cysticercus ٦٠ .bovis

The name cysticercus is derived from the Greek kystis—bladder and kerkos—) .(tail

The cysticercus is an ovoid, milky white opalescent fluid-filled vesicle measuring

about 5 mm by 10 mm and contains the invaginated unarmed scolex. The cysticerci

can be seen on visual inspection as shiny-white dots in the infected beef (measly

.(beef) (Fig. 10.7

When such infected beef is eaten raw or inadequately cooked, the cysticerci are

,digested out of the meat in the stomach. In the upper part of the small intestine

the head evaginates out of the cysticercus, becomes attached to the mucosa and by

gradual strobilisation develops into the adult worm in about 2 to 3 months. The adult worm has a lifespan of 10 years or more. Infection is usually with a single worm, but sometimes multiple infection is seen and 25 or more worms have been .reported in some patients

Pathogenesis

The adult worm, in spite of its large size causes surprisingly little inconvenience to the patient. It may lead to vague abdominal discomfort, indigestion and .diarrhoea

Occasional cases of acute intestinal obstruction and acute appendicitis have been reported. The proglottides crawling out the anus, particularly during the day time .may cause alarm or embarrassment

.The larva of T. saginata(cysticercus bovis) is not found in humans

Fig. 10.7: Larvae of cyclophyllidean tapeworms. 1 Cysticercus, a typical bladder with the invaginated protoscolex. e.g. T. solium. 2. Cysticercoid, a fleshy larva with the head withdrawn and surrounded by a double fold of integument. e.g. H. nana. 3. Coenurus larva with multiple invaginated protoscolices, e.g. M. multiceps. 4. Echinococcus. Hydatid cyst with internal budding producing brood capsules with multiple scolices. e.g. E. granulosus

Epidemiology

Human infection follows consumption of raw and undercooked beef and so is related to local eating habits. The formerly popular practice of prescribing raw or rare beef

or beef juice for debilitated persons had been responsible for many infections in .the West

Diagnosis

The diagnosis is often made by the patient who feels the proglottides crawling down the anus unexpectedly or notices them in stools. Microscopic examination of faeces shows the eggs. Salt floatation is not suitable for concentrating eggs in faeces; formol-ether sedimentation method is useful. Species identification cannot be made from the eggs. This can be done by examining with a hand lens, the gravid proglottid pressed between two slides, when uterine branching can be made .(out (15 to 20 lateral branches in T. saginata; under 13 in T. solium

Treatment

Niclosamide and praziquantel are effective. Purgation is not considered .necessary

Prophylaxis

Beef should be subjected to effective inspection for cysticerci and should be eaten .only after proper cooking. The critical thermal point for cysticerci is 56°C

Other preventive measures consist of prevention of faecal pollution of soil and .proper disposal of sewage

TAENIA SOLIUM

History and Distribution

Commonly called the pork tapeworm, this has been known from the time of .Hippocrates

However, it was differentiated from the beef tapeworm only by Kuchenmeister ((1855

and Leuckart (1956) who worked out its life cycle and demonstrated the larval stage

in the pig. Kuchenmeister fed a condemned prisoner with 20 cysticercus cellulosae

from a pig and when the criminal was executed four months later, 19 adult T. solium

.were recovered from his intestines

Various derivations have been proposed for the name ‘solium’—from the Latin

solus meaning solitary because usually only a single worm is found in infected ,persons

or sol meaning sun from a fancied resemblance of the rostellum with hooks to the

.’sun and its rays, and from a Syrian word meaning a ‘chain

T. soliumis worldwide in distribution, except in the countries and communities

.which proscribe pork as taboo

Morphology and Life Cycle

The adult worm lives in the human intestine, usually in the jejunum, where it lies

in several folds in the lumen. Commonly only a single worm is present, but rarely

.several worms may be seen, upto 25 or more in a patient

The adult worm is usually 2 to 3 metres long. The scolex is roughly quadrate

about 1 mm in diameter, with 4 large cup-like suckers (0.5 mm in diameter) and

a conspicuous rounded rostellum, armed with a double row of alternating round

and small dagger-shaped hooks, 20 to 50 in number. The neck is short and half as

.thick as the head

The proglottides number less than a thousand. They resemble those of T. saginata

in general. The gravid segments are twice as long as broad, 12 mm by 6 mm. The

testes are composed of 150 to 200 follicles. There is an accessory lobe for the .ovary

The vaginal sphincter is absent. The uterus has only 5 to 10 (under 13) thick lateral

branches. A lateral thick-lipped genital pore is present, alternating between the right

.and left sides of adjacent segments

The gravid segments are not expelled singly, but pass passively out as short .chains

The eggs escape from the ruptured wall of the uterus. The eggs are indistinguishable

from those of T. saginata. They remain infective for several weeks in soil. They can

.(infect pigs as well as humans (Fig. 10.8

FIGURE 10.8: Life cycle of Taenia solium. 1. Adult worm in human small intestine. .A

Scolex and neck. B. Immature segments. C. Mature segments, showing genital pore

opening laterally alternating between right and left . D. Gravid segments. 2. Scolex bearing

four suckers and a rostellum with a double row of hooks (Fig. 10.9) 3. Mature segment

longer than broad. Uterus has few branches. (5-10). 4. Immature egg with hyaline

embryonic membrane around it. 5. Mature egg deposited in soil, ingested by pig, or

occasionally by man. 6. Oncosphere penetrates intestinal wall. 7. Cysticercus cellulosa

develops in muscle (measly pork), the infective stage for humans

When the eggs are ingested by pig or humans, the embryos are released in the

duodenum or jejunum. The oncospheres penetrate the intestinal wall, enter the

mesenteric venules or lymphatics and are carried in systemic circulation to the different

parts of the body. They are filtered out principally in the muscles where they develop

.into the larval stage, cysticercus cellulosaein about 60 to 70 days

The cysticercus cellulosae or 'bladder worm' is an ovoid opalescent milky-white

bladder or vesicle surrounded by a fibrous capsule. It contains a thick fluid, rich

in protein and salt. The scolex of the larva, with its suckers, lies invaginated within

the bladder and can be seen as a thick white spot. It remains viable for several

months. The cysticercus measures usually about 5 mm by 10 mm, but can be much

.larger when it occurs in the brain or subarachnoid space

Cysticercus cellulosae can develop in humans or pigs. In humans it is a dead end

and the larvae die without further development. When pork containing cysticercus

cellulosae (measly pork) is consumed inadequately cooked, the larvae are digested

out of the meat in the stomach and duodenum. The head evaginates out of the bladder

and becomes attached to the jejunal mucosa. In 5-12 weeks it develops into a mature

.worm. T. soliumhas a long lifespan of about 25 years or more

Pathogenesis

The adult worms do not cause any disturbance apart from vague abdominal discomfort, indigestion or alternating diarrhoea and constipation. It is the larval stage

.that can cause serious trouble

Cysticercus cellulosae develop in humans following ingestion of T. soliumeggs

,in water or vegetables. In persons harbouring the adult worm in the intestine

autoinfection and infection of close contacts can take place by finger contamination

with eggs from the perineal skin or faeces. Autoinfection can also occur by the gravid

segments reaching the stomach by retrograde peristalsis from the jejunum, whereupon

.they are digested and thousands of eggs released

Cysticercus cellulosae may be solitary or more often multiple, commonly .numerous

Any organ or tissue may be involved, the most common being subcutaneous tissues

and muscles. It may also affect the eyes, brain, and less often the heart, liver, ,lungs

abdominal cavity and spinal cord. The symptomatology depends on the site .affected

The cysticercus is surrounded by a fibrous capsule except in the eye and ventricles

on the brain. The larvae evoke a cellular reaction starting with infiltration of

neutrophils, eosinophils, lymphocytes, plasma cells and at times giant cells. This is

.followed by fibrosis and death of the larva with eventual calcification

In cysticercosis of the brain, symptoms are more often due to the dead and calcified

larvae than the living larvae. Epilepsy is the most common manifestation, but it can

also cause behavioural disorders, pareses or hydrocephalus. Ocular cysticercosis may

.cause blurring of vision, uveitis, iritis and ultimately blindness

Epidemiology

Intestinal infection with T. soliumoccurs only in persons eating undercooked pork

and so is related to food habits. It is therefore absent in those with religious or

FIGURE 10.9: T. solium hooks

other reservations against eating pork. But cysticercosis may occur in any person

residing in endemic areas, even in vegetarians because the mode of infection is

.contamination of food or drink with eggs deposited in soil

Diagnosis

Infection with the adult worm is diagnosed by demonstration of eggs, or more

specifically of proglottides in faeces. It can be differentiated from T. saginataon

.the characteristics of the proglottides

Definitive diagnosis of cysticercosis is by biopsy of the lesion and its microscopic

examination to show the invaginated scolex with suckers and hooks. Cysticercosis

in the subcutaneous tissue and muscles, particularly in the buttocks and thighs

can be made out by radiological demonstration of the calcified larvae.
Radiography

is helpful for diagnosis of cerebral cysticercosis also, but CT scan is much more

.useful. Ocular cysticercosis can be made out by ophthalmoscopy

Eosinophilia usually occurs during the early stage of cysticercosis, but is not constant. An indirect haemagglutination test has been repored using an antigen .obtained from cysticercus from pigs

Treatment

Praziquantel and niclosamide are useful in treatment of infection with the adult worm. For cysticercosis excision is the best method wherever possible. Praziquantel .and metrifonate have been reported to be effective in cysticercosis

Prevention

Proper meat inspection in slaughter houses to eliminate measly pork, adequate cooking of pork, clean personal habits and general sanitary measures can prevent the infection. For control of cysticercosis, prevention of faecal contamination of ,soil proper disposal of sewage and avoiding raw vegetables grown in polluted soil are useful measures. It is important to detect and treat persons harbouring adult worms .as they can develop cysticercosis due to autoinfection

ECHINOCOCCUS GRANULOSUS

History and Distribution

Tapeworms belonging to the Genus Echinococcushave, as their definitive host a carnivorous predator that preys on the intermediate host which is usually a herbivorous mammal. The domesticated example of this is Echinococcus ,granulosus the dog tapeworm or the hydatid worm (formerly called Taenia echinococcus), which

has the dog as the definitive host and sheep and humans as the principal intermediate

.hosts. In humans it causes unilocular echinococcosis or hydatid disease

.Hydatid cysts had been described by Hippocrates and other ancient physicians

It was only in 1782 that Goeze recognised their relationship to tapeworms by studying

.their scolices

The disease is prevalent in most parts of the world, though it is most extensive

in the sheep and cattle-raising areas in Australasia, parts of Africa and South .America

It is also common in Europe, China and the Middle East. It occurs in many parts

.of India. It is seen more often in temperate than in tropical regions

Morphology and Life Cycle

The dog is the principal definitive host. The adult worm lives in the jejunum and

duodenum of dogs and other canine carnivora, with its scolex buried in the ,mucosa

.between the villi. Enormous numbers of them may be seen in infected dogs

,It is a small tapeworm, measuring only 3-6 mm in length. It consists of a scolex

a short neck and the trunk composed of only 3 proglottides, the anterior ,immature

.the middle mature and the posterior gravid

The scolex is pyriform, with 4 suckers and a prominent rostellum bearing two

circular rows of hooklets. The terminal proglottid is longer and wider than the rest

.of the worm and contains the branched uterus filled with eggs

The eggs are indistinguishable from those of Taeniaspecies. They are passed in

dog faeces. Sheep and cattle ingest them while grazing. The egg-shell disintegrates

in the duodenum setting free the hexacanth embryos which penetrate the intestinal

wall and enter the portal venules, to be carried to the liver along the portal .circulation

The liver acts as the first filter for the embryos which get arrested in the sinusoidal

capillaries. Of the embryos that escape, many get filtered out in the pulmonary

capillaries, so that the lung acts as the second filter. A few enter the systemic circulation

and get lodged in various organs and tissues such as the spleen, kidneys, eye, brain

.(or bones (Fig. 10.10

FIGURE 10.10: Life cycle of Echinococcus

granulosus. 1. Adult worm in intestine of dogs. It

consists of a pyriform scolex with four suckers

and rostellum bearing hooklets and three

proglottides—immature, mature and gravid, 2. Egg

deposited in soil. 3. When ingested by animals (or

,humans) hexacanth embro penetrating intestine

settles in liver, lung, or other sites to form hydatid

cystid containing protoscolices which are infective

to dogs, hydatid cyst in humans is a blind end

At the site of deposition the embryo develops into a bladder or cyst filled with

fluid. This becomes the hydatid cyst (Greek hydatis—a drop of water). It enlarges

slowly and reaches a diameter of 0.5 to 1 cm in about 6 months. The growing cyst evokes host tissue reaction leading to the deposition of a fibrous capsule around it. The cyst has a thick opaque white outer cuticle orlaminated layer, and a thin inner germinal layercontaining nucleaed cells. The germinal layer is the site of asexual reproduction. It also secretes the hydatid fluid which fills the cyst. The fluid is ,clear colourless or pale yellow, with a pH of about 6.7, containing salts and protein. It

is a good antigen which sensitises the host. The fluid was used as the antigen for .(Casoni's intradermal test and other diagnostic serological tests (Fig. 10.11

From the germinal layer, small knob-like excrescences or gemmulesprotrude into the lumen of the cyst. These enlarge, become vacuolated and filled with fluid. These are called brood capsules. They are initially attached to the germinal layer by a ,stalk but later escape free into the fluid filled cyst cavity. From the inner wall of the brood capsule, protoscolicesdevelop, which represent the head of the potential adult ,worm complete with invaginated scolex, bearing suckers and hooklets. Each of these is a potential tapeworm. Several thousands of protoscolices develop in a mature hydatid cyst, so that this represents an asexual reproduction of great magnitude. Many of the scolices float free in the cyst fluid. These, together with the free brood capsules .are called the hydatid sand

FIGURE 10.11: Hydatid cyst. 1. Outer

.laminated layer 2. Germinal layer 3

Gemmule 4. Brood capsule 5. Protoscolex

Sterile daughter cyst .٦

Inside mature hydatid cysts, further generations of cysts may develop—daughter

cysts and granddaughter cysts. The cyst grows slowly, often taking 20 years or more

to become big enough to cause clinical illness. Unilocular cysts are usually less than

cm in diameter, but occasionally may grow to 20 cm or more in size, with about ٥

litres of fluid inside. E. granulosustypically forms unilocular hydatid cysts, but ٢

may rarely produce multilocular cysts. Sometimes the scolices may escape from the

cyst and get transported to other parts of the body, where they may initiate secondary

hydatid cysts. Some cysts are sterile and may never produce brood capsules, while

.some brood capsules may not produce scolices. These are called acephalocysts

When hydatid cysts form inside bones, because of the confinement by dense

osseous tissue, the laminated layer is not well-developed. The parasite migrates along

the bony canals as naked excrescences that erode the bone tissue. This is called the

osseous hydatid. When sheep or cattle harbouring hydatid cysts die or are ,slaughtered

dogs may feed on the carcass or offal. Inside the intestine of dogs, the scolices develop

into the adult worms that mature in about 6 to 7 weeks and produce eggs to repeat

.the life cycle. The adult worm lives from 6 to 30 months

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FIGURE 10.12: E. granulosus brood capsules in cross section

,The above is the natural cycle of the parasite. When infection occurs in humans

the cycle comes to a dead end, because the human hydatid cysts are unlikely to

.be eaten by dogs

Pathogenesis

Human infection follows ingestion of the eggs passed by infected dogs. This may

occur by eating raw vegetables or other food items contaminated with dog .faeces

Fingers contaminated with the eggs while fondling pet dogs may carry them to the

mouth. Kissing pet dogs may cause the eggs to be transferred directly to the .mouth

Infection is often acquired during childhood when intimate contact with pet dogs

is more likely. But the clinical disease develops only several years later, when the

hydatid cyst has grown big enough to cause obstructive symptoms. Disease results

.mainly from pressure effects caused by the enlarging cysts

In about half the cases the primary hydatid occurs in the liver, mostly in the

right lobe. Hepatomegaly, pain and obstructive jaundice are the usual .manifestations

The next common site is the lung, usually in the lower lobe of the right lung. ,Cough

haemoptysis, chest pain and dyspnoea constitute the clinical picture. In the ,kidney

,hydatid cyst causes pain and haematuria. Other sites affected include the spleen

.brain, orbit and bones. Erosion of bone may lead to pathological fractures

A second pathogenic mechanism in hydatid disease is hypersensitivity to the

echinococcal antigen. The host is sensitised to the antigen by minute amounts of

hydatid fluid seeping out through the capsule. Hypersensitivity may cause .urticaria

But if a hydatid cyst ruptures spontaneously or during surgical interference, massive

.release of hydatid fluid may cause severe, even fatal anaphylaxis

Epidemiology

Human hydatid disease is only a tangenital accident in the natural cycle of the hydatid

worm. The natural intermediate reservoir hosts are sheep, cattle, pigs and a large

,variety of herbivores, from elks to elephants. The dog is the usual definitive host

although several wild canines have been found infected in nature. The definitive

hosts are predators and the intermediate hosts the preys, except for humans who

.constitute a blind alley in the cycle of transmission

Diagnosis

Radiological examinations and other imaging techniques such as ultrasonography

and CT scan reveal the diagnosis in most cases. Blood eosinophilia is often ,present

but is not constant or diagnostic. Exploratory puncture of the cyst yields hydatid

fluid and demonstration of scolices in the hydatid sand provides conclusive .diagnosis

But this procedure is risky and not recommended as it may cause escape of hydatid

.fluid and consequent anaphylaxis

Immunological methods employed include the Casoni's intradermal test and serological tests. The Casoni's test is an immediate hypersensitivity test originally introduced by Casoni in 1911. The antigen is hydatid fluid collected from animal or human cysts and sterilised by Seitz or membrane filtration and is injected (0.2 ml) intradermally on one arm and an equal volume of saline as control on the other arm. In positive cases a large wheal, about 5 cm in diameter, with multiple pseudopodial projections appears within 20 to 30 minutes at the test site and fades

in an hour. A secondary reaction consisting of oedema and induration appears after 8 hours. The test is very sensitive, but not specific and false-positive reactions

may appear in a number of other conditions. Casoni's test is little used now and .has been supplanted by serological tests

An active cyst is associated with the presence of circulating antibodies, which increase in titre when there is a leak of hydatid fluid. High levels of antibodies are seen with cysts in the liver, though lung cysts may not cause a similar antibody ,response. Following surgical removal, suppuration or calcification of the cysts .antibody levels decline

,The serological tests used are CFT, IHA, latex agglutination, immunofluorescence immunoelectrophoresis and ELISA. CFT is not very sensitive and false-positive

reaction is seen in those receiving neural antirabic vaccine. CFT is useful after

surgical removal of cysts, when a negative test has a better prognostic value. The

slide latex agglutination test and IEP using hydatid fluid fraction 5 antigen are widely

used. ELISA for demonstration of circulating hydatid antigen is also helpful in

diagnosis. Specific molecular diagnostic methods have been developed involving

DNA probes and polymerase chain reaction, but their application is limited by their

.technical complexity

Treatment

Surgical removal offers the best mode of treatment where the cysts are .accessible

But recurrence after surgery is common. Drug treatment has only limited .application

.Mebendazole, albendazole and praziquantel have been used

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Prophylaxis

Infection of dogs can be prevented by ensuring that they do not eat animal carcass

or offal. Destruction of stray dogs has been found to be helpful. Periodical deworming

of pet dogs is useful. It is essential to wash the hands after touching dogs. Kissing

.of pet dogs should be discouraged

ECHINOCOCCUS MULTILOCULARS

This causes the rare but serious condition of alveolar ormultilocular hydatid disease

in humans. It is found in the northern parts of the world, from Siberia in the East to Canada in the West. The adult worm is smaller than E. granulosusand lives in the intestines of foxes, dogs and cats. Human infection develops from eating fruits or vegetables contaminated with their faeces. Rodents are the main intermediate .hosts

The liver is the organ most often affected. The multilocular infiltrating lesion appears like a grossly invasive growth that can be mistaken for a malignant .tumour

.It may also metastasize to the lungs and brain

The prognosis is very grave. Surgical removal, when possible is the best method .of treatment. Mebendazole has been reported to be of some value

HYMENOLEPIS NANA

Commonly known as the dwarf tapeworm, Hymenolepis nana is the smallest and the most common tapeworm found in the human intestine. The name Hymenolepis refers to the thin membrane covering the egg (Greek hymen—membrane, lepis—rind or covering) and nana to its small size (nanus—dwarf). It is cosmopolitan in distribution but is more common in the warm than in cold climates. Infection is most common in school children and institutional populations. It is unique that it completes its life cycle in one host, the parasite being maintained by transmission between ,humans and even in a single individual, who can act as both the definitive and intermediate

.host

The adult worm lives in the human intestine, often in large numbers. It is 5 to mm long and less than 1 mm thick. The scolex has 4 suckers and a retractile ٤٥ rostellum with a single row of hooklets. The long slender neck is followed by the .strobila consisting of 200 or more proglottids, which are much broader than long .Eggs are released in the intestine by disintegration of the distal gravid segments

The egg is roughly spherical or ovoid, 30 to 45 µm in size, with a thin colourless outer membrane and an inner embryophore enclosing the hexacanth .oncosphere

The space between the two membranes contains yolk granules and 4 to 8 polar filaments arising from two knobs on the embryophore. The eggs float in saturated .(salt solution (Fig. 10.13

Infection occurs by ingestion of the eggs, by faecal oral transmission from person to person or in the same individual. Internal autoinfection may also occur when the eggs released in the intestine hatch there itself. No intermediate host is .required

H.nanais unusual in that it undergoes multiplication in the body of the definitive .host

When the eggs are swallowed, or in internal autoinfection, they hatch in the duodenum or jejunum. The hexacanth embryo penetrates a jejunal villus and develops

,into the cysticercoid larva. This is a solid pyriform structure, with the vesicular .anterior end containing the invaginated scolex and a short conical posterior end

After about 4 days, the mature larva emerging out of the villus evaginates its scolex

and attaches to the mucosa. It starts strobilisation, to become the mature worm which

.begins producing eggs in about 25 days

FIGURE 10.13: Life cycle of Hymenolepis nana. 1. Adult worm in human

intestine, showing scolex with four suckers and retractile rostellum bearing

hooklets, a slender neck and strobila. 2. Mature proglottid much broader

than long. 3. Egg passed in stools, showing hexacanth embryo, polar

,filaments and outer membrane. 4. When egg is ingested by humans

cysticercoid larva develops in intestine and grows into adult worm. Entire

life cycle can be passed in one host

A different strain of H. nanainfects rats and mice. The eggs passed in rodent

faeces are ingested by rat fleas (Xenopsylla cheopisand others) which act as the

intermediate host. The eggs develop into cysticercoid larvae in the haemocele of

these insects. Rodents get infected when they eat these insects. The murine strain

does not appear to infect man. However, the human strain may infect rodents, which

may, therefore, constitute a subsidiary reservoir of infection for the human .parasite

Infection with H. nanadoes not generally produce any illness. Symptoms may

sometimes occur due to an allergic response. These include abdominal discomfort

diarrhoea and pruritus. The diagnosis is made by demonstration of the eggs in .faeces

Praziquantel and niclosamide are effective in treatment. Prevention is by proper

.personal hygiene

HYMENOLEPIS DIMINUTA

This is called the rat tapeworm and is a common parasite of rats and mice. The name

diminuta” is a misnomer as it is larger than H. nanabeing 10 to 60 cm in length. “ Its

life cycle is similar to that of the murine strain of H. nana. Rarely, human infection follows

.accidental ingestion of infected rat fleas. Human infection is asymptomatic

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