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Hydatidosis and its effects on humans and animals

A Graduation Project Submitted to the Department Council of the Internal and Preventive Medicine-College of Veterinary Medicine/ University of Al-Qadisiyah in a partial fulfillment of the requirements for the Degree of Bachelor of Science in Veterinary Medicine and Surgery.

By
_____Student_____
Mariam Mohanad Mohammed
Reiyam Atshan Oreibi

Supervised by
_____Adviser_____
Prof. Dr. Noaman Naji A'aiz

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فَتَعَٰلَى ٱللَّهُ ٱلْمَلِكُ ٱلْحَقُّ ۗ وَلَا تَعْجَلْ بِٱلْقُرْءَانِ مِن قَبْلِ أَن يُقْضَىٰٓ
إِلَيْكَ وَحْيُهُۥ ۖ وَقُل رَّبِّ زِدْنِى عِلْمًا ﴿١١٤﴾

صَدَقَ اللهُ العَظِيمُ

من سورة طه

Certificate of Supervisor

I certify that the project entitled (**Hydatidosis and its effects on humans and animals**) was prepared by **Mariam Mohanad Mohammed** and **Reiyam Atshan Oreibi** under my supervision at the College of Veterinary Medicine / University of Al-Qadisiyah.

Supervisor

Prof. Dr. Noaman Naji A'aiz

Coll. Of Vet.Med./ Univ. of Al-Qadisiyah.

1 / 6 / 2021

Certificate of Department

We certify that **Mariam Mohanad Mohammed** and **Reiyam Atshan Oreibi** have finished them Graduation Project entitled (**Hydatidosis and its effects on humans and animals**) and candidate it for debating.

Instructor

Dr. Muthanna H. Hussain

-- / -- / 2020

Head of Dept of Int. and Prev. Med.

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Chapter One
Introduction

Introduction :

Cystic Echinococcosis (CE) or hydatidosis caused by the larval stage of a zoonotic tapeworm *Echinococcus granulosus* which is endemic in the most regions of the world (Oku *et al.*, 2004; Sadjjadi, 2006; Torgerson and Deplazes, 2009).

As mentioned by Eckert and Deplazes, (2004); Budke *et al.*, (2006); Ahmadi and Bodi, (2011) ,The adult worm is living in the small intestine of canids members as definitive host, mostly dogs and wolves. The herbivores are infected with *E. granulosus* when grazing the contaminated herbage with the canids feces contains *E. granulosus* eggs. However, humans can be accidentally infected by swallowing eggs with contaminated food, water and directly when contacted with infected dog. In livestock, the infection with *E. granulosus* caused a considerable economic loss in milk and meat production, edible organs and decreased in fecundity. The high infection rates and the global distribution of (CE) is return to the wide range species of infected intermediate hosts. However, the infection rate of human is related with the infection rate of domestic animals specially dogs and sheep. More than one global study reported that *E. granulosus* had variable strains in different regions of the world, which had different routes in epidemiology, pathology, control, and prevention. Today, there are ten distinct strains or genotypes identification as G1- G10. Romig, (2003); Jenkins, (2005); Tiaoying *et al*., (2005) found these genotypes are associated with distinct intermediate hosts like sheep, Buffalo, horses, cattle, camels, pigs, cervids, goats, and others.

In Iraq, hydatid cyst is one of the most endemic diseases in both humans and animals, which caused some significant human problems in health and economic activities.

Chapter Two

Review of literatures

2-1 Classification:

The classification of *Echinococcus* genus has been controversial for a long time, and 16 species and 13 subspecies of this genus have been described, based on the difference in the structural and phenotypic properties of the parasite and the characteristics of the host and its type, but only 4 of them are taxonomically adopted: *E. granulosus, E. multilocularis, E. oligarthrus, and E. vogeli.* According to the classification system of granulocytic parasitic parasite is as follows (Thompson and McManus, 2002) :

Kingdom: Animalia
Phylum: Platyhelminthes
Superclass: Eucestoda
Class: Cestoda
Subclass: Cestoda
Order: Cyclophyllidea
Family: Taeniidae
Genus: Echinococcus
Species: *E. granulosus*

2-2 Morphology

Parasite morphology: Tape-worms form three different developmental stages: eggs; larvae; and adults. Adult *E. granulosus* worms are small (2-6mm long) and have a scolex with only three attached segments. The scolex has four lateral suckers and the rostellum is non-retractable and armed with a double crown of 28-50 recurved hooks. The anterior segment is immature, the middle segment is mature with functional testes

and ovaries, and the posterior segment is gravid with the uterus filled with eggs (Eckert *et. al*, 2001a).

Kemp and Amy, (2001); Thompson and McManus, (2001); Eckert and Deplazes, (2004) mentioned the eggs are typical for most taeniid species and are small and round (30-43µm in diameter), thick-shelled and contain a hexacanth (6-hooked) embryo (oncosphere) (McManus, 2009).

The encysted larval (metacestode) stage is known as a bladder-worm or hydatid, and it produces multiple infective stages (protoscoleces, apparent as invaginated scolices already containing suckers and hooks) either directly from the germinal layer of the cyst wall, or by forming brood sacs (hydatid sand) by endogenous (internal) or exogenous (external) budding of the germinal layer. *E. granulosus* forms fluid-filled unilocular cysts with endogenous budding of brood capsules, *E. vogeli* forms fluid-filled polycystic cysts with exogenous budding, and *E. multilocularis* forms fluid-free multilocular or alveolar cysts with exogenous budding (Eckert *et al*., 2001a).

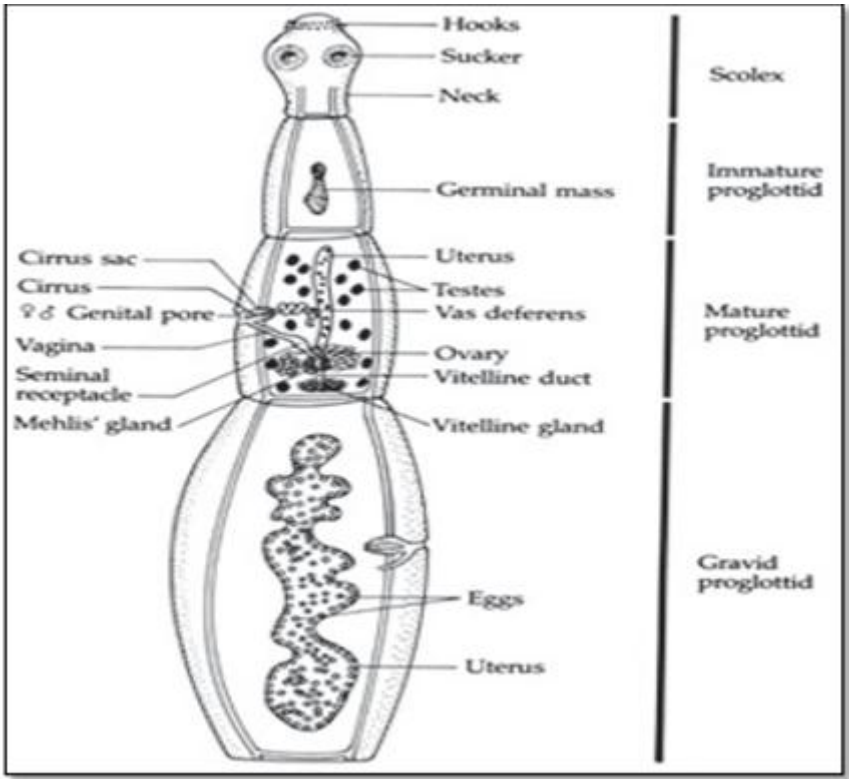

Figure (2-1) *E. granulosus* adult tapeworm (King and Hutchinson, 2007).

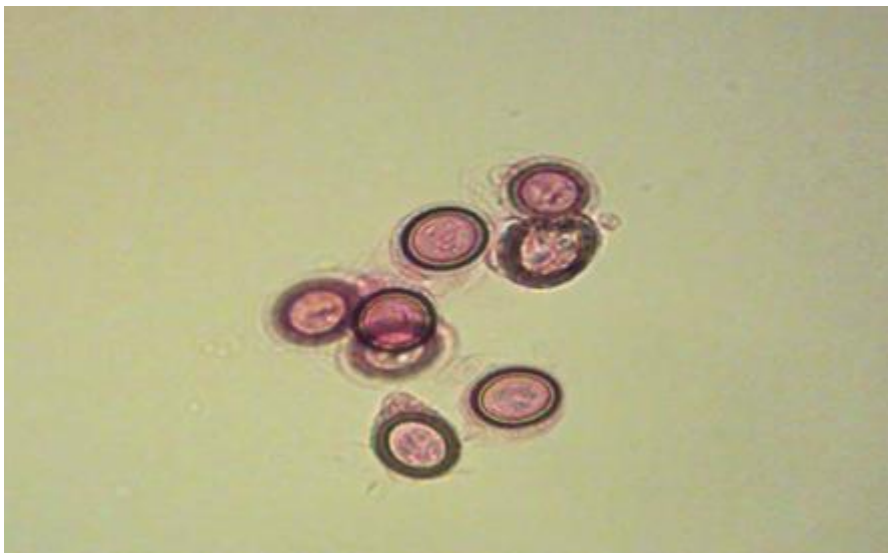

Figure (2-2) *E. granulosus* eggs (Ghaffar and Brower, 2010).

Figure (2-3): *E. granulosus* Protoscoleces

2-3 Host:

E. granulosus occurs in most sheep and cattle producing areas around the world. Canids act as definitive hosts for adult worms, while omnivorous/herbivorous mammals (humans, domestic animals and wildlife) serve as intermediate hosts for encysted larval stages (Rajaii, 2005).

2-4 The Life Cycle of the parasite

The adult phases of the *E. granulosus* lives in the mucous layer of the definitive host's small intestine, and mentioned by Paksoy *et al.*, (2005), the eggs are highly resistant to harsh environmental conditions for several months or even a year depending on environmental conditions. Therefore, it remains a source of infection to the intermediate hosts during drinking contaminated water and food, including humans that may also be infected by contact with infected dogs, especially in children, whereas eggs adhere to dog hair around the anus (Thompson and McManus, 2002; Eckert and Deplazes, 2004).

The eggs reach the stomach of the intermediate host and then decompose the chitinous cortex by digestive juices and release the embryo (oncospheres) of the sixth-hooks, and the oncospheres penetrate the intestine and reach the liver, lungs, and other organs including the brain and muscles to develop into hydatid cysts at the end of about 5 months (the wildlife cycle) (Eckert and Deplazes, 2004).

When the definitive host feeds on infected organs of the intermediate host, the parasite will reach its small intestine, where the primary heads grow into adult worms within 7–4 weeks, and each worm produces thousands of eggs per day, starting the cycle again (Figure 2-4).

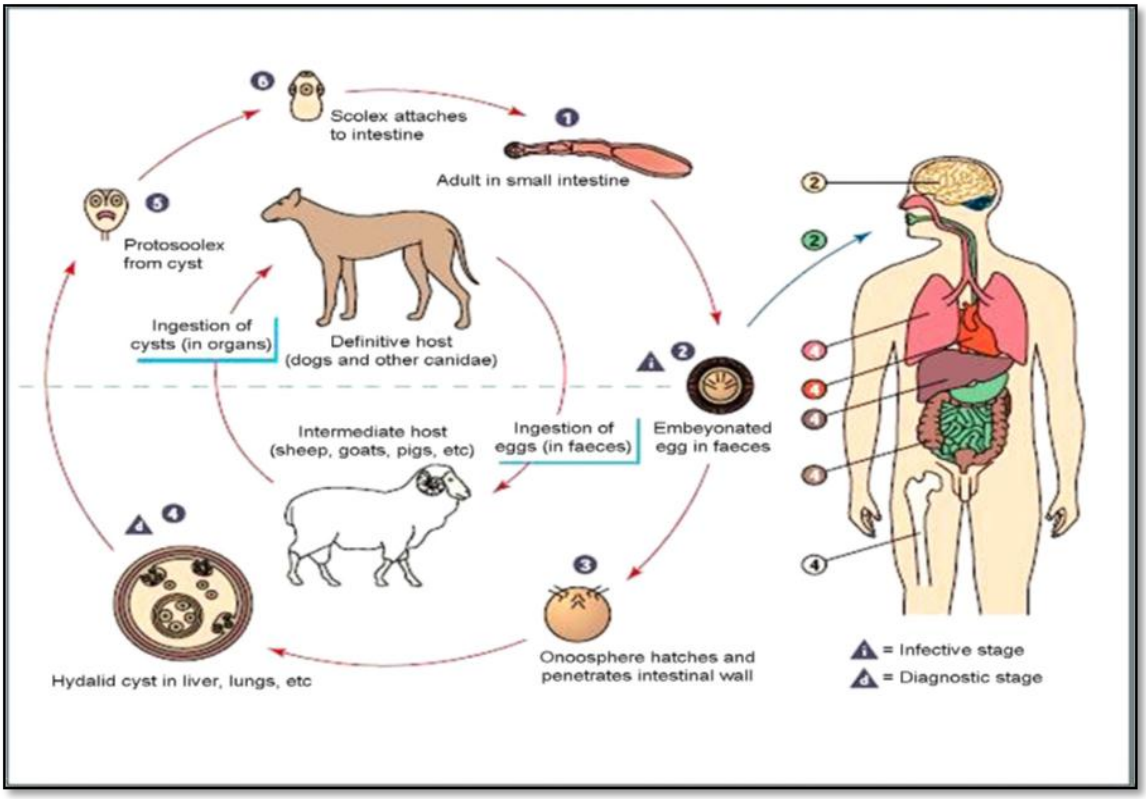

Figure 2-4: Life cycle of *E. granulosis* (Moro and Schantz, 2009).

The adult *E. granulosus* (2–7 mm long) resides in the small intestine of the definitive host. Gravid proglottids release eggs that are passed in the feces and are immediately infectious. After ingestion by a suitable intermediate host, eggs hatch in the small intestine and release six-hooked

oncospheres that penetrate the intestinal wall and migrate through the circulatory system into various organs, especially the liver and lungs. In these organs, the oncosphere develops into a thick-walled hydatid cyst that enlarges gradually, producing protoscolices and daughter cysts that fill the cyst interior. The definitive host becomes infected by ingesting the cyst-containing organs of the infected intermediate host (Torgerson and Budke, 2003).

After ingestion, the protoscolices evaginate, attach to the intestinal mucosa, and develop into adult stages in 32–80 days. Humans are aberrant intermediate hosts and become infected by ingesting eggs . Oncospheres are released in the intestine , and hydatid cysts develop in a variety of organs (Diaz *et al.*, 2011a).

If cysts rupture, the liberated protoscolices may create secondary cysts in other sites within the body (secondary echinococcosis) (Eckert *et al.*, 2001a; Polat *et al.*, 2003).

2-5 Clinical symptoms of hydatidosis

Hydatis cyst disease (HCD) is slow at the onset of infection and unseen due to slow growth and development of the cyst, which reaches a diameter of about 10–1 mm per year (Eckert and Deplazes, 2004). The appearance of clinical signs depends on the location of the affected organ, the size of the cyst, its location within the affected organ, the stages of its development, and the fertility of its components with the interaction between the related cysts between adjacent organs, especially between the hepatic vessels and bile ducts. In humans, the symptoms are dependent on the affected organ, and the liver is the most exposed organ, with a rate of about 70–60%, followed by lungs 22–20%, spleen, heart, muscles, eye,

and thyroid gland 6%, and the kidneys, brain, and bones 1% and don't hardly any organ of body free from hydatid cyst except teeth, nails and hair (Al-Jabalawi, 1999).

Symptoms in the liver are: an enlarged, and it becomes sensitive when palpated with liver abscesses, in addition abdominal pain, vomiting and nausea, as well as an increase in hepatic blood pressure and in cavity of the lower vena cava also there secondary fibrosis in the ducts bile, the hydatid cyst causes significant pressure on the diaphragm when adhesion to it and leads to a breach and exit of the contents of the cyst in the chest. In the lung, clinical symptoms depend on the size of the cyst and its condition whether it is healthy or torn, causing the presence of pressure of cyst inside the lobes of the lung with varying severity of chest pain and coughing, hemoptysis, shortness of breath, and hemorrhage, and in the lungs, these symptoms do not appear at the first sight of the disease . When the cyst penetrates into the pulmonary vesicles, it is a suitable environment for fungal and bacterial infections, leading to pneumonia after infection and thus destroying the lung (Junghanss *et al*., 2008).

The explosion of the hydatid cyst inside the abdominal cavity leads to a shock known as anaphylactic shock due to acute allergic reactions, and this shock leads to the severe spread of secondary cysts in the affected organ and adjacent organs, and is sometimes followed by the explosion of the cyst at any site within the body leaking its contents into the blood circulation that leads to headaches and other complications that may lead to sudden death (Siracusano *et al*., 2009).

The symptoms develop even when the cyst is small, and most cases of cerebral cyst disease were diagnosed in children. This infection is serious that sometimes it leads to death; cysts in the eye are rare and cause an external tumor of the eye, dysfunction of vision,

exophthalmoses, and sometimes blindness around the eyelid (Kul and Yildiz, 2010).

Martin- Hernando *et al*., (2008) explain in the bones, cystic hydatid disease often leads to fracture because of the gradual erosion of the cortex and shows symptoms in the form of pain in the upper and lower extremities, and bone bags are abnormal in the form where the laminar layer does not form

In animals, the infection is hidden, and they may be slaughtered sometimes before the onset of symptoms. The severity of the symptoms varies depending on the severity of the disease and the location of the hydatid cyst. Clinical signs generally appear in the affected animal such as decrease in milk production, poor wool, and organ damage in the affected area (Moro and Schantz, 2009).

2-6 Pathogenesis

The adult stages are considered benign and do not cause disease in dogs, as the worms do not invade or feed on host tissues. Encysted larval stages generally do not cause clinical disease in domestic livestock as they are often confined to visceral tissues (Eckert *et al.*, 2001a).

However, significant pathological changes occur in humans when the slowly-growing cysts put pressure on surrounding tissues and produce chronic space-occupying lesions. Cysts may grow around 1 mm per month and can become extremely large, up to 30cm in diameter with litres of fluid containing thousands of protoscoleces. Organ enlargement may be accompanied by a variety of clinical signs depending on the size and location of the cysts. Compression of liver may result in jaundice, portal hypertension and abdominal distention (Gutierrez, 2000; Marquardt *et al.*, 2000).

Cysts in the lung may cause haemoptysis (coughing up blood), dyspnoea (difficulty breathing) and chest pain. Cysts in the brain or spinal cord can provoke acute inflammatory responses and numerous neurological sequalae, including epilepsy and blindness. Cyst rupture has been associated with acute clinical signs (such as peritonitis and pneumothorax), and the sudden release of hydatid fluid may cause severe allergic reactions (such as asthma and anaphylactic shock). Protoscoleces released from ruptured cysts can regress and form new hydatid cysts throughout the body (Pawlowski *et al.,* 2001; Ahmed, 2011).

2-7 Diagnosis

There are many ways to diagnose Echinococcosis. One of the most common ways to diagnose Hydatid disease is to look for the presence of asymptomatic cysts. Many asymptomatic cysts can be located using Ultrasound Imaging. This technique is identical to that of imaging a developing fetus. The cysts show up as sharp outlines on the ultrasound image, and occasionally fluid levels can be detected. CT and MRI scans are also useful in detecting cysts that are on the liver and/or spleen (Siles-Lucas and Gottstein, 2001; Brunetti *et al.,* 2010).

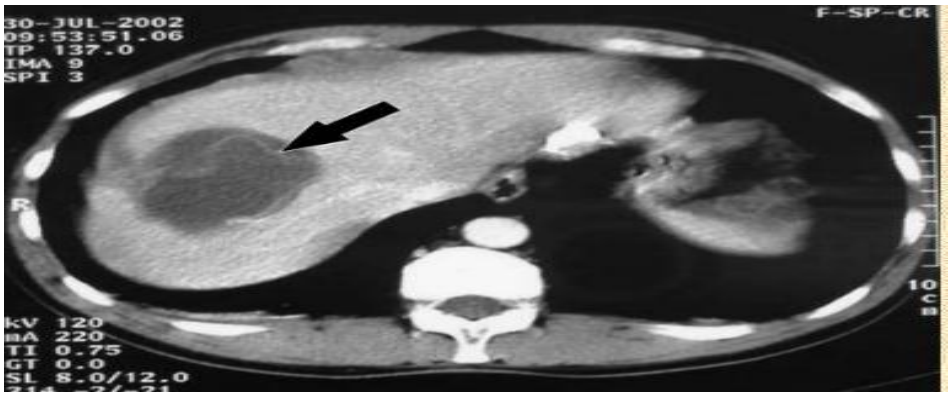

Figure 2-5: The image of the upper abdominal region, with a large cyst on the liver (arrow).

Diagnosis of Echinococcosis can also be done through serologic tests, including Immunoblot, Indirect Hemagglutination test (IHA), and Enzyme-linked Immuno sorbent Assay (ELISA). These serologic tests 80-100& effective with liver cysts, but only 50-60% effective when cysts are located on other organs. When a cyst ruptures, there is an abrupt stimulation of antibodies, but when these cysts calcify or die, they become sero-negative. If the CT scan shows a cyst, a diagnosis should be made - regardless of confirmation by serology (King, 2000; Wilson & Schantz, 2000) A Casoni skin test can also be administered to diagnose hydatid disease (Craig *et al.*, 2007).

Figure 2-6: Man's arm showing positive skin test for hydatid disease.

2-8 Treatment and control

Despite some promising indications, the treatment of hydatid disease with conventional anthelmintic drugs has not proven wholly effective, being complicated by the large size and inaccessible location of cysts and their thick, possibly impenetrable, walls. Variable results have been

obtained using praziquantel and mebendazole, while albendazole and niclosamide have been less effective (Moghaddam *et al.*, 2011).

The only remaining treatment option is for the surgical removal of cysts, provided they are in favourable sites. Surgeons must take care not to rupture cysts as protoscoleces may spread to new sites to form more cysts. Scolicide chemicals, such as cetrimide, may also be used during surgery to sterilize excision sites (Smego *et al.*, 2003; Siracusano *et al.*, 2009).

In contrast, infections by adult worms in dogs can be successfully treated with praziquantel, and it is advisable to confine dogs and/or use purgatives to facilitate the collection and disposal of infected faeces. Preventing dogs from becoming infected involves eliminating offal and other potentially infected material from their diets, curbing their hunting behaviour, properly disposing of carcases in the field, and culling wild and feral dogs. Several countries have developed highly successful hydatid eradication campaigns based around dog management and treatment. Recently, a recombinant vaccine has been developed to prevent hydatid formation in domestic herbivores, and is undergoing further evaluation. While control may be possible in situations involving pastoral cycles, there will be many problems accessing wildlife involved in sylvatic cycles (Torgerson and Budke, 2003).

Chapter Three

Recommendations

Recommendations

1. Public health education programs according to different level of community like medical and veterinary services should be done.
2. Establishment of modern healthy abattoirs and prevent illegal (backyard) slaughtering.
3. Routinely treatment of dogs with anti-parasitic medicines and prophylactic anthelminthic dosage in four times yearly for all farm animals.
4. Using of recombinant vaccine (EG95) in farm animals to prevent growth of onchospheres into hydatid cysts.
5. Advanced studies to involve a wide area of Iraq in addition to wide range of livestock that nearby to human to diagnosis of more incidence infected strain.

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