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Prasanna Kumar V
Veterinary Officer, Veterinary Dispensary, Dalasanur, Srinivaspura, Kolar, Karnataka, India

Prem Kumar R
Veterinary Officer, Veterinary Dispensary, Madanahalli, Kolar, Karnataka, India

Sunitha R
Assistant Professor, Department of Veterinary Public Health, Veterinary College, Gadag, Karnataka, India

Pradeep Kumar V
Veterinary Officer, Veterinary Dispensary, Alabanur, Raichur, Karnataka, India

Corresponding Author:
Prasanna Kumar V
Veterinary Officer, Veterinary Dispensary, Dalasanur, Srinivaspura, Kolar, Karnataka, India

Echinococcosis: A review

Prasanna Kumar V, Prem Kumar R, Sunitha R and Pradeep Kumar V

Abstract
Echinococcosis/hydatidosis is a zoonotic parasitic disease caused by the dog tapeworm Echinococcus and its larval stage, the hydatid cyst. It is characterized by the formation of variably sized cysts in the visceral organs of the intermediate hosts and adult tapeworm in the intestine of dogs. The disease is chronic and affects all kinds of food animals, including herbivorous and omnivorous mammals. Echinococcosis is associated with severe morbidity and disability and is one of the world's most geographically widespread zoonotic diseases. Hydatid disease results in loss of millions of money in terms of public health each year and lowered productivity of infected animals. The objective of this seminar paper is to review the epidemiology, pathogenesis, diagnosis, control and prevention of hydatidosis.

Keywords: Echinococcosis, tapeworm, zoonotic disease, cyst

Introduction
Echinococcosis, also called hydatid disease or hydatidosis, is a zoonosis, and in humans it occurs as a result of infection by the larval (metacestode) stages of taeniid cestodes of the genus Echinococcus. Six species have been recognized, but four are of publichealth concern: *Echinococcus granulosus* (which causes cystic echinococcosis), *Echinococcus multilocularis* (which causes alveolar echinococcosis) and *Echinococcus vogeli* and *Echinococcus oligarthrus* (which cause polycystic echinococcosis). It is characterized by long-term growth of metacestode (larval) stages (hydatid cysts) in internal organs (mainly the liver and lungs) of intermediate host animals, *viz.*, sheep and goats. Accidentally, eggs are also ingested by humans but do not play a role in the natural cycle [1].
Echinococcosis or hydatidosis is a neglected cyclozoonotic disease affecting humans and their livestock, thereby causing significant socioeconomic and public health impacts, mostly in developing countries [2]. The disease has a worldwide distribution and its prevalence varies among regions due to climate difference and agro ecology, level of education and development condition [3]. The distribution of *E. granulosus* is higher in developing countries, especially in rural communities where there is close contact between the dog, the definitive host and various domestic animals, which may act as intermediate host [4]. The present paper reviews the lifecycle, etiology, clinical signs, diagnosis, treatment and prevention and control measures.

Life cycle
There are two hosts in the life-cycle of the parasite. The first one is the primary host or definitive host, and the second one is the intermediate host in which the illness occurs. Adult forms are present in the intestines of primary hosts including cats, dogs, wolfs and foxes, andhere, they only cause intestinal parasitosis but not organ disease. Adult parasite lives approximately for 5 months in dog intestines [5]. Definitive hosts spread millions of parasite eggs on defecation. Sheep and other herbivorous animals becomes intermediate host for the parasite when they eat herbs contaminated with these eggs, or humans become "intermediate host" for the parasite when they eat food contaminated with these eggs. Embryo (oncosphere) which comes out of the egg taken via gastrointestinal tract, adheres to intestinal wall with its hooks, then enters into circulation and reaches firstly to the liver. Thus, liver is the most common site of disease in humans accounting for 50–70% of cases, followed by the lungs (20–30%), and less frequently the spleen, kidneys, heart, bones, central nervous system, and other organs. Embryo loses its scolex when it settles in an organ, and takes the cyst form consisting of cuticula (exocyst) and germinal membrane (endocyst). The cyst has sterile, clear fluid inside and this cystic structure is wrapped with a fibrous capsule pericyst.

When alive hydatid cysts are eaten by the last host dog the infection chain is completed and the life cycle returns to beginning [6].

Etiological agent

At present, four species of the genus Echinococcus are recognized and regarded as taxonomically valid: *E. granulosus* (cystic hydatidosis), *E. multilocularis* (multivesicular hydatidosis), *E. vogeli* (poly cystic hydatidosis) and *E. oligarthrus* [7]. These four species are morphologically distinct in both the adult and the larval stages. Adult Echinococcus is a very short tapeworm only rarely more than mm long and usually has no more than six segments. Like all tapeworms, Echinococcus has no gut and all metabolic interchange takes place across the syncytial outer covering tegument. Interiorly, the adult Echinococcus possesses an attachment organ, the scolex, which has four muscular suckers and two rows of hooks, only large and one small, on the rostellum [8]. The body or strobila is segmented and consists of a number reproductive unit (proglottids), which may vary in number from two, to six. The adult worm is hermaphrodite with reproductive ducts opening at a common, lateral, genital pore, the position of which may vary depending on species and strain. There is a prominent cirrus sac, which may be horizontal or titled anteriorly and the vitellarium is globular. The uterus dilates after fertilization, eventually occupying most of the terminal segment when the eggs are fully developed [9].

Clinical manifestations

After ingestion, Echinococcus eggs hatch and release embryos in the small intestine. Penetration through the mucosa leads to blood borne distribution to the liver and other sites, where development of cysts begins. Most primary infections in humans consist of a single cyst; however, 20-40% of individuals have multiple cysts or multiple organ involvement [10]. The liver is the most common site of the echinococcal cyst of the pastoral strains, followed by the lungs, the cyst is seen less frequently in the spleen, kidneys, heart, bone, and central nervous system.

Even though infections may be acquired in childhood, most cases of liver and lung cysts become symptomatic and are diagnosed in adult patients because of the slowly growing nature of the echinococcal cyst. Only 10-20% of cases are diagnosed in patients younger than 16 years. However, cysts located in the brain or an eye can cause clinical symptoms even when small; thus, most cases of intracerebral echinococcosis are diagnosed in children.

Diagnosis

The diagnosis is based on history, clinical examination, Serology and Imaging. Microscopic examination of the cyst content confirms the diagnosis. Over the last decade diagnosis of hydatid disease was improved due to the use of imaging techniques including ultrasonography, computed tomography (CT scanning) and magnetic resonance imaging (MRI) supported by immunological assays for confirmation of clinical diagnosis [11]. Recently, a PCR for specific detection of DNA from *E. granulosus* egg has been developed. Immuno diagnosis involves the detection of parasite antigens in feces (coproantigens) and serum antibody detection. ELISA has been described for several groups for the detection of coproantigens released by cestodes, including Taenia species of dogs and humans [12].

Treatment

The current methods of treatment include surgery (consisting of conservative and laparoscopic), and percutaneous drainage (consisting of puncture, aspiration, injection and re-aspiration; PAIR); these methods are mainly helpful for liver cysts. The method alternative to PAIR or surgery for the treatment of muscle, spleen or kidney-cysts includes percutaneous drainage without re-aspiration [13].

Medical treatment with albendazole and mebendazole demonstrated efficacy is useful in the management of patients with hydatid cysts in liver and lungs. The combined chemotherapy with albendazole and praziquantel has been used and found more effective than monotherapy with these agents. Flubendazole alone, or in combination with ivermectin was reported effective [14]. Pre-surgical chemotherapy of *E. granulosus* infections reduces the size and number of viable protoscolices and as has been documented the percutaneous treatment in combination with albendazole has been found more effective than surgical cystectomy [15].

Prevention and control

Echinococcosis can be controlled through preventive measures that break the life cycle between the definitive and inter-mediate hosts. These measures include a complete deprivation of dogs from the access of infected raw offal's by proper disposal of hydatid cysts possessing condemned offal's at abattoirs, local slaughterhouses, back yards and on farms. Further control methods include introduction of appropriate meat inspection, establishment of local slaughterhouses, education of the people, effective implementation of legislative measures, burning or burial of condemned offal's and sterilization of offal's, if it is going to be used as dog food [16]. Specific control measures including stray dogs' control, registration of all owned dogs, spaying of bitches and treatment of all (or most) dogs with praziquantel at predetermined intervals for example every 6-8 weeks [17]. Prevention can be achieved by strict hygiene measures like hand washing after animals handling, in particular dogs. Control of movements of food animals and dogs from the infected areas to the clean ones; marking and control of movements of animals from infected flocks or herds [18].

Application of an effective vaccine to reduce hydatid infection in livestock would be likely to have a substantial impact on the rate of transmission of the disease to humans [19]. Echinococcus vaccines would ideally prevent oncosphere development to hydatid cysts in sheep, and thus stop the development of adult gravid tapeworms in dogs [19]. Large controlled studies with sheep have shown that vaccination with a recombinant oncospheral EG95 induces high degree of protection, reducing the cyst numbers in vaccinated animals by approximately 90 to 100%. There is no vaccine for dogs, although research is under way [20]. Community ultrasound surveys have been used to raise awareness in communities considered to be at risk [22]. Currently there are no human vaccines against any form of Echinococcosis. However, there are studies being conducted that are looking at possible vaccine candidates for an effective human vaccine against Echinococcosis [23].

Conclusion

Hydatidosis is an important zoonosis and is a serious public health and economic problem throughout the world. In domestic ruminants it inflicts enormous economic damage

due to the condemnation of affected organs and lowering of meat, milk and wool production. The disease is chronic and affects all kinds of food animals, including herbivorous and omnivorous mammals. The public health importance of echinococcosis includes cost of hospitalization, medical and surgical fees, losses of income and productivity due to temporal incapacity to work, social consequences, due to disability and mortality.

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