Review Article

Hydatid disease, a morbid drop needs awareness

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Abstract

Hydatid disease is classified as a neglected disease by the world health organization WHO. In this article, we review the different aspects of this disease, with a special emphasis on the molecular epidemiology and surgical treatment of hydatid disease in Sudan.

Keywords: cystic echinococcosis, genotyping, camels, Sudan

Introduction

Hippocrates was probably the first to describe Hydatid disease when he described (when the liver is filled with water and bursts into the epiplon, in this case the belly is filled with water and the patient dies)\(^1\). Abu Bakr Mohamed Ibn Zakariya al-Razi, a Persian physician in AD 900, described a hydatid cyst of the liver. The following comment on the Hippocratic aphorism quoted above is translated from al-Razis’ original book Al-Hawi in medicine: ’watery balloons may form in the liver within its investing membrane more often than in other organs\(^2\).

The etiological agents and its character were delineated during 17th and 18th centuries, but the complete life cycle was documented not until 19th century. Hydatid is a Greek word meaning “a drop of water”. Hydatid disease is a zoonotic infection caused by larval forms (metacestodes) of the tapeworm of the genus echinococcus found in the small intestines of carnivores. Cystic hydatid disease caused by Echinococcus granulosus is still an important and challenging medical problem and endemic in many countries world-wide\(^3\). Humans are not a part of the natural life cycle of the parasite Echinococcus granulosus, in which adult tapeworms (3-6 mm long) inhabit the small intestine of carnivorous definitive hosts, such as dogs, coyotes, or wolves, and echinococcal cyst stages occur in herbivorous intermediate hosts, such as camels, sheep and cattle\(^3,4\).

Humans become infected by ingesting tapeworm eggs passed from an infected carnivore. This occurs most frequently when individuals handle or contact infected dogs or other infected carnivores or inadvertently
ingest food or drink contaminated with fecal material containing tapeworm eggs. Incidental human infestation with larval form results in formation of hydatid cysts in various parts of the body, the liver and lungs being the most common site\(^{(3,5,6)}\). Since the parasite has evolved mechanisms to avoid host immunity; the infection is often asymptomatic until a mechanical complication occurs, such as rupture (into the biliary tree, bronchial tree, or peritoneum), compression of vital structures, hemorrhage, or tissue failure (particularly with bone involvement).

**Epidemiology of hydatid disease**

Cystic echinococcosis (CE) has a global distribution\(^{(7)}\). In sub-Saharan Africa, CE is considered to be highly endemic, with variable distributions in different countries\(^{(8)}\). Studies in western Uganda indicate that CE is a public health and an economic problem in Uganda, with 20 surgical cases of CE per year reported to hospitals in some area\(^{(9)}\). In Turkana, Kenya, the prevalence of CE in humans is about 2.5%\(^{(7)}\) data on human CE in western and southern Africa are missing. However, a hospital-based study in Nigeria showed that 5.1% of patients have ultrasonography features of intra-abdominal CE\(^{(10)}\). In Burkina Faso, the prevalence of 0.007% in humans has been reported\(^{(11)}\).

In Sudan, the disease was first reported in dogs in 1962 where the prevalence of hydatid disease in dogs was 86.4%\(^{(12)}\). In 1987, another study found a prevalence of 12% and 10.3% in sheep and goats respectively.

Saad and Magzoub (1988) stated that the prevalence of hydatid disease in dogs in Tambool area was 51%. On 2001, a survey-based study carried out in southern Sudan reported a prevalence of 2% in humans\(^{(13)}\). In central Sudan, a recent ultrasound survey with 300 and 651 people in two different areas showed prevalence in humans between 0.3% and 0.8%, respectively\(^{(14)}\). In southern Sudan the prevalence of CE among Bouya people was 2%\(^{(15)}\) and 3.5% among Toposa\(^{(16)}\). In 2005, an ultrasound survey by Elamin et al in Tambool area, central eastern Sudan, showed a prevalence of 0.92% of hydatid cysts in humans (M Elamin Ahmed et al, unpublished data). A more recent and extensive survey in the same area revealed a percentage of (1.04%) of patients screened having features of liver hydatid cysts on abdominal ultrasonography\(^{(17)}\).

In Sudan, lung hydatid disease is a common finding, a hospital based-study in three large centres in Khartoum showed that the lung was the affected site in 44.7% of the Sudanese patients with hydatid disease (M Elamin Ahmed et al)\(^{(18)}\). However, whether or not this finding reflects the real situation in the community needs to be investigated through large-scale population based studies.

**Molecular epidemiology and characterization of Echinococcus granulosus**

Ten genotypes of Echinococcus granulosus (EC) designated (G1- G10) are recognized worldwide. The sheep strain (G1), cattle strain (G5) and camel strains (G6) are enzootic in North Africa including the Sudan. The cysts of different strains can be distinguished by molecular methods such as polymerase chain reaction (PCR) and DNA sequencing. Although these PCR-based detection assays proved highly sensitive and specific, they do require individual testing of each submitted sample for the genotype-specific detection and subsequent identification of the genotype using specific primers in PCR amplification. This limitation renders these conventional PCR-based detection assays rather time consuming, which is not the case for real time PCR which is rapid can be quantitative, but equipments are more expensive.

Recent epidemiological studies in Sudan indicated that the camel genotype (G6) was reported to be the most prevalent strain (Ahmed and Aradaib; 2006)\(^{(19,20,21)}\). The G6 strain was found to be endemic in camels, goats, cattle and humans while E. Ortleppi (or
cattle strain G5 of E. granulosus), was only found in cattle in Sudan(20). On the other hand, the common sheep strain (G1) which is suspected to be the principal genotype, affecting humans in sub-Saharan Africa, was not found and therefore appears to be rare or even absent in the central Sudan(8). In another study CE isolates from five human patients from western and southern Sudan were characterized using genotype specific PCR and sequencing and confirmed that camel strain (G6) infects humans in Sudan(27). The sporadic occurrence of this genotype may signify its lower pathogenicity to humans(27). However, this (G6) strain of E. canadensis has been previously identified from human patients all over the world(20,22,23,24,25,26).

Diagnosis of hydatid disease
Early diagnosis of hydatid disease can result in significant improvements in the quality of the management and treatment of the disease(28). The definitive diagnosis for most human cases of hydatid disease is by physical imaging methods, such as radiology, ultrasonography, computed tomography (CT scanning) and magnetic resonance imaging(28) although such procedures are often not readily available in isolated communities. Radiologic findings can range from cystic lesions to a completely solid appearance according to the stage of growth of the cyst or associated complications(29). Ultrasonography is particularly useful for the detection of septa and hydatid sand with floating echinococcal membranes(29). In 2003, the World Health Organization proposed a classification based on US features and included five types: type 1 is a well-defined, anechoic lesion; type 2 demonstrates separation of the membrane (the "water lily" sign formed by the undulating membrane); type 3 is characterized by the presence of septa and intraluminal daughter cysts. Type 4 is a nonspecific solid mass. Type 5 is a solid mass with a calcified capsule(29). CT scanning may reveal fluid content within the cyst, with a density close to that of water; daughter cysts when present appear as curved septations(30). On CT the cyst walls can range in thickness from 2-mm to 1-cm, with the wall representing the combined pericyst, ectocyst, and endocyst(30).

Treatment and control of hydatid disease
Albendazole and Mebendazole are two benzimidazoles used for the treatment of cystic echinococcosis. Long-term treatment with Albendazole has a particularly marked effect on the cyst and is used as pre-treatment before surgery(31). Surgery remains the primary treatment and the only hope for complete cure(32). The basic steps of the procedure are eradication of the parasite by mechanical removal, sterilization of the cyst cavity by using a scolicidal agent, and protection of the surrounding tissues and cavities. Scolicidal agents include formalin, hydrogen peroxide, hypertonic saline, chlorhexidine, absolute alcohol, diluted povidone iodine and cetrimide. A variety of complications has been described with all scolicidal agents. Other scolicidal agents are 70-95% ethanol and 15-20% hypertonic saline solutions. A report by Ochieng'-Mitula and Burt in 1996 on the injection of ivermectin in the hydatid cysts of infected gerbils revealed severely damaged cysts with no viable protoscoleces(33). Further evaluation of this scolicidal agent is needed. At surgery, the exact location of the cyst is identified and correlated to radiologic findings. In our practice, we used to use dry large gauze pads in for protection of the surrounding tissues and diluted povidone iodine for the cavity sterilization. This ensures both mechanical and chemical evacuation and destruction of all cyst contents. During this process, care is taken to ensure no spillage occurs to prevent seeding and secondary infestation. In pulmonary cysts, if the lesion is involving most of a lung lobe, lobectomy is the best procedure. Mini invasive procedures such as Laparoscopy for liver and abdominal hydatid and Video assisted thoracoscopy (VATS) has
been recently used widely. Better forms of chemotherapy and newer methods, such as the puncture, aspiration, injection, and reaspiration (PAIR) technique is now available in Sudan (32).

Data on the control of hydatid disease in Sudan, and probably in the whole region of sub-Saharan Africa, is missing, and hydatid disease is classified by the World health Organization WHO as a neglected disease. In Sudan, the main efforts on controlling human hydatid disease are operated by the Sudan Hydatid Research project, with is a part of African sub-Saharan project on cystic echinococcosis. In this project, two areas are targeted; Tambool area in central eastern Sudan, where camels are predominant, and the second is South Western Sudan (east and west Nuba Mountains, nearby villages to Kadogli) where cattle are the most dominant animals. In Tambool area, extensive surveys using portable ultrasound were done, with identification, treatment, and education and follow-up campaigns on a regular basis. These efforts are coordinated with the veterinary counterparts, for the control of the disease in the livestock animals. The main obstacles are the lack of sufficient funds regarding the management, in addition to the nomadic nature of the local population.

In conclusion, cystic hydatid disease is a common and significant public health problem in some areas in Sudan. More efforts should be exerted to explore the different aspects of this disease, both from a medical and veterinary perspective. Control for dogs and hand hygiene are very effective mode for prevention. When symptomatic: surgery is still the mainline of treatment and more cheap than medical treatment available. Laparoscopy and PAIR technique for liver hydatid and thoracoscopic surgery are less invasive where facilities and expertise available are very useful. More research will be needed for more rapid effective and less expensive medicines.

References


