

## Cystic Echinococcosis: With Emphasis on Treatment Options

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Cystic echinococcosis (CE), also known as hydatid disease, is an important zoonotic parasitic disease with public health significance caused by the larval stages of the cestode *Echinococcus granulosus* [1, 2]. It causes characteristic cystic lesions most commonly found in the liver and lungs, but it can arise anywhere in the body [3,4]. Humans as accidental or aberrant intermediate host are infected either by direct contact with dogs or by consumption of water or foods contaminated with feces of dogs containing eggs of parasite [4,5]. Although CE is endemic in developing and tropical countries in South America, Africa, Mediterranean countries and the Middle East, it has a worldwide geographical distribution [2,4,6]. The diagnosis is made by a set of diagnostic methods including certain serologic and laboratory tests including immunofluorescence (IF), enzyme-linked immunosorbent assay (ELISA), and imaging or scanning techniques such as abdominal ultrasound (US), X-ray, computed tomography (CT) and magnetic resonance imaging (MRI) [7-10].

When hydatid disease is diagnosed, treatment should be performed to prevent complications such as secondary infection, rupture of the cyst to adjacent tissues, rupture with intraperitoneal dissemination of the disease, anaphylactic reaction, and pressure on adjacent organs [9]. The treatment of hydatidosis relies on some options such as chemical or medical therapy, surgery and puncture aspiration injection reaspiration [6,11]. In cases of the difficult accessibility to the lesion, the poor condition of patient for surgery, aged and pregnant patients, dead or calcified cysts, very small cysts, and inoperable patients with multiple cysts in two or more organs, medical treatment including benzimidazoles (mebendazole and albendazole) or praziquantel are suggested [9-11]. Albendazole sulfoxide loaded solid lipid nanoparticles (SLN) has been introduced as an efficient therapeutic regimen in treating hydatidosis in animals and humans [6]. It has been shown that warm water (50-60°C) is a scolicidal agent, but *in vivo* scolicidal activity of this method is dubitable [12]. The side effects of the medical therapy comprise bone marrow suppression, pancytopenia, agranulocytosis, alopecia and the changes in hepatic enzyme levels [9]. For surgery, regard should be given to issues such as cyst location, number of cysts, probable complications and status of the patients. Surgical techniques include liver resection, pericystectomy, and partial or total pericystectomy [8, 9]. Principles of surgery are based on inactivating infectious scolices and germinal layers, preventing contamination or spillage, total cystectomy without sacrificing other organs, evacuation of the cyst content without disseminate into the peritoneal cavity, eliminating all viable elements like endocyst, and managing the residual cavity [9,13].

Due to the development in technology and the increasing number of more experienced surgeons, laparoscopic surgery has been introduced for the surgical treatment of hydatid disease [11]. Firstly, laparoscopy was not widely used in the treatment of CE due to the concern regarding the higher recurrence rate and the risk of intraperitoneal dissemination with laparoscopy than with the conventional approach. Advantages of laparoscopic surgery comprise non-invasiveness, less hemorrhage, less postoperative pain, faster postoperative recovery, reduced wound complications, possible to examine the cyst cavity in more detail, aesthetic outcomes and fast healing [9,11,13]. Disadvantages include the difficulty of access to certain locations, limited area to manipulate,

concerns regarding control of hemorrhage and embolism, difficulty in aspirating the thick and dense cyst content and an increase in the risk of dissemination and anaphylaxis [11,13]. Surgery is the treatment of choice and the only method that completely removes the parasitic cysts and fluid [13]. Nevertheless, when evaluation of the advantages of the laparoscopic approach, the disadvantages of the minimally invasive approach are set aside [11]. Considering the previously mentioned well-known benefits, the laparoscopic approach offers an alternative to conventional surgery for the treatment of hydatid cysts and is worthy to be considered for suitable situations [8, 11]. Laparoscopic radical surgery combines the advantages of radical and laparoscopic surgery [13]. There are two techniques: total closed cystectomy and partial hepatectomy. The low morbidity and zero recurrence in liver, taking into account the short follow-up, suggest that radical techniques should be considered the therapeutic option of choice whenever feasible [13]. Currently, surgery remains the most common method for CE treatment that lead to complete cure, but it involves risks including anaphylactic reactions, secondary CE due to spillage of viable parasite (protoscolices) materials and those associated with any surgical intervention [4,8].

In some instances, combination of pulmonary and hepatic hydatid cysts occurs that poses a challenge in terms of surgical accessibility. For these cases, Boudaya et al. [4] recommended that the left-sided thoracic approach is feasible and provide good outcome. When a cyst is attached to the abdominal wall, percutaneous aspiration, without need for operation, and alcohol injection and reaspiration can be useful, while once a cyst has an intra-abdominal location, complete or partial cystectomy, with or without drainage, or omentopexy are the options [9]. Concerning the recurrence of the disease, organ resection and total pericystectomy provide the best outcomes; however, they carry some operative and postoperative complications. PAIR and laparoscopic surgery have been introduced as minimally invasive methods. Combination of chemotherapy and surgery or PAIR is increasingly being used. Preoperative treatment with albendazole may facilitate a complete removal of the germinal layer, and reduce the rate of recurrence [4]. An alternative procedure for treating CE is by the combination of puncture, aspiration, injection, reaspiration (PAIR) [6,7,9]. Since the risk of recurrence remains the major problem in surgical or medical treatment, post-treatment/surgical follow-up of patients with hydatid disease for several years is usually required. Useful imaging techniques for follow-up of CE patients are sometimes difficult to detect the newly growing small cyst and also

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to differentiate dead and viable cysts [10]. It has been recommended that the preoperative and postoperative medical prophylaxis with benzimidazoles and praziquantel in cases of spillage of protoscolices may reduce the risk of secondary echinococcosis [9,10]. Nonetheless, controversies still exist about the preferred operating technique for the disease. On the one hand, the prevalence of infection among the final hosts, namely dogs, the risk of infection to human beings is also very likely, effective programs is needed to be designed for controlling and reducing the disease in dogs and therefore humans. On the other hand, treatment and management of human echinococcosis remains a significant medical issue and challenge particularly in endemic areas. For these purposes, the search for new less harmful, yet more effective drugs and techniques is ongoing. Additionally, genotyping of human cases of the disease, by molecular identification of the parasitic isolates including G1 (sheep strain), G3 (buffalo strain), G5 (cattle strain), G6 (camel strain) genotypes, plays an important role in the formulation of control strategies for the control and prevention of transmission of this metacestode [5,14].

Most anti-helminthic drugs are absorbed poorly from the gastrointestinal tract and so, they do not reach adequate concentrations within the cyst cavity to kill the parasites. Therefore, drug administration is not adequately effective and is not expected to replace surgery in the near future, the standard treatment for CE remains surgery.

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