*IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*
*e-ISSN: 2279-0853, p-ISSN: 2279-0861. .Volume 15, Issue 3 Ver. I (Mar. 2016), PP 43-46*
*www.iosrjournals.org*

# Hydatidosis

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***Abstract:*** *Hydatid disease is a preventable parasitic disease caused by the Echinococcus, a tapeworm. Even in this 21st century, it is still not eradicated. Hence, even now we should know about hydatidosis. This review article includes a brief introduction followed by pathology. The various clinical features are discussed in detail. The common complications and some unusual complications are mentioned. A brief discussion covers the various investigations to diagnose the hydatid disease. Though the surgery is the main modality of treatment in hydatidosis, the role of medical treatment is discussed in detail. In this era of minimal access surgery, a brief discussion on laparoscopic surgery in hydatidosis is also included.*
***Key Words:*** *Hydatidosis; Echinococcus.*

## I. Introduction

Hydatidosis is a parasitic disease caused by the larval stage of a cestode, belonging to the genus, Echinococcus. There are three important species which produce significant morbidity and mortality in humans. Echinococcus granulosus is the commonest and cause cystic echinococcosis (CE). Echinococcus multilocularis is rare, but is more virulent and causes alveolar echinococcosis (AE). Echinococcus vogeti is the rarest.

Echinococcus granulosus is common in the sheep rearing areas like Mediterranean countries, the Middle East, the Central Asia, Iceland, Australia, New Zealand and southern part of South America (1). Though it is a preventable disease, even in this 21st century, it is still not yet eradicated and manifests significantly in certain countries including India. In Greek, hydatid means" watery vesicle".

**Life Cycle**

The adult parasite resides in the jejunum of dog, a definitive host. Eggs are passed in the stool and ingested by the intermediate host like sheep or man. The eggs are hatched in the duodenum and the larvae pass through the intestinal mucosa into the portal circulation and are filtered mostly in the liver. Those escape, enter systemic circulation, and filtered in the lung (2).

Two biological types are recognized depending on the geographical location and type of intermediate host.

(A). The Northern Type

(B). The European Type

The Northern type is maintained in Tundra region by wolf and rein deer. Humans are affected by when rein deer is domesticated. The European type is commonly seen in sheep rearing areas including India. The life cycle is maintained by sheep, whereas the human is an accidental intermediate host, where the life cycle of the parasite comes to an end.

## II. Pathology

Once the parasite in its larval stage reaches liver or lung or any other organ in the body, it develops into a hydatid cyst. This hydatid cyst is formed as a result of continuous asexual multiplication in the intermediate host including human being as long as the host is alive. If the parasite survives host defense mechanism, in about a week's time after infestation, the larva develops into a 6-7 mm vesicle. This is an endocyst and is made of two different layers. The inner layer is known as the germinal membrane. It is the living part of the parasite and contains the proteigenous layer. The outer layer is the protective laminated membrane formed by the growing parasite all around it. It is known as the ectocyst. This laminated layer never grows thicker than 2.5 mm regardless of the cyst size. It is the one which gets calcified later on in an inactive or dead cyst.

Compression and interaction of the growing parasite with the adjacent host's tissue especially of a solid organ like liver, produce a fibrous layer derived from the host organ. It is called the pericyst. This pericyst is easily separated from the underlying ectocyst by a small capillary space. According to Chinese workers, this pericyst consists of two different distinct layers as a result of two different formation processes. The inner layer is the result of an inflammation and granulomatous reaction aimed at walling of the parasite and resorbing the releasing antigen from the parasite. This granulomatous layer increases in size with the growth of the parasite. It contains 'osteopontine'. It regulates macrophage accumulation and calcium deposition. The outer layer is the

true adventitious layer and is composed of compressed surrounding host tissue. In liver, it is typically composed of compressed 'Glissonian' – biliary – vascular elements. Separating this outermost adventitious layer from the inner layer of the cyst is the basis of 'sub adventitious cystectomy', pioneered by the Chinese surgeons to reduce the recurrence rate. The outer layer measures about 1 to 1.5 cm in thickness and it is not present in the lung and brain (3). In the center of hydatid cyst, the hydatid fluid is present, formed by the inner germinal membrane. It exerts about 30 to 70 cm of water pressure. In addition, the germinal membrane produce daughter cysts through endogenous vesiculation. The daughter cysts are 'true replication' of the mother cyst but without a pericyst. The formation of the daughter cysts is considered as the defense reaction of the parasite for its survival in the host tissue.

Host defense mechanism, injury and the functional status of the pericyst are the factors that determine the cyst vitality, growth and development.

## III. Clinical Features

Theoretically, any organ can be affected. The liver is the most common organ involved followed by the lung. The symptoms depend on the site, size, the parasitic load, vitality and stage of development of the cyst.

Most of the cysts are detected incidentally on ultrasound imaging for unrelated symptoms. Most cysts, if symptomatic are larger than 5 cm in size and these symptoms are nonspecific either as a result of mass effect or pressure effect. Clinical latency is an important aspect of hydatidosis, expect when the cyst is located in the brain or in the eye (4). Only the complicated cysts produce specific symptoms.

**Liver Hydatid Cyst**

The patient may have vague nonspecific upper abdominal pain or sensation of fullness. If complication in the form of rupture into the biliary system occurs, the classic triad of biliary colic, jaundice and urticaria may occur.

**Lung Hydatid Cyst**

The patient complains of recurrent bouts of cough with haemoptysis and sometimes with expectoration of cyst membrane, low grade fever, dyspnea and pleuritic chest pain.

**Brain Hydatid Cyst**

The patient presents with convulsions or with features suggestive of increased intra cranial pressure. Hydatid cyst in the extremity or in the trunk present with mass effect. Rarely the patient may present with rupture or with nerve compression symptoms.

Though it is a parasitic disease, features of anaphylaxis are rare. The hydatid cyst may produce complications. In hepatic hydatid cyst, the cyst may develop cysto-biliary communication. If this communication is not detected in time, secondary bacterial infection can occur. If this is not detected early, the patient may die of septicaeemia. Occasionally rupture of the hydatid cyst may occur. The rupture may be internal into the space between the pericyst and the ectocyst resulting in multivesicular cyst. Rarely the cyst may rupture freely as a result of increased intra cystic pressure resulting in severe anaphylactic shock and death. Very rarely, the cyst may rupture silently into the peritoneal cavity resulting in disseminated peritoneal hydatidosis. If the hydatid cyst is present superficially under the diaphragm, it may rupture into the thoracic cavity resulting in pneumonitis or lung abscess or broncho-biliary fistula.

**Primary versus Secondary Echinococcus :**

The hydatid cyst forming from the hatched egg during asexual cycle in an intermediate host like a sheep or a man is called the 'primary echinococcosis ', whereas, a new hydatid cyst developed from the daughter cyst in the same intermediate host subsequent to rupture of primary cyst or invasion into the surrounding area or as a result of operative procedure is known as the secondary echinococcosis (5).

**Investigations:**

Usually, routine laboratory blood work results are nonspecific. Increased eosinophil count is observed in only 25% cases. Hypo gamma globulinaemia is seen in 30%. If liver parenchyma is affected, there may be elevation of serum bilirubin and alkaline phosphate levels. If the cyst is infected, there may be a rise of total leucocyte count.

Diagnosis is usually based on imaging studies. Plain radiography is normal, unless there is calcification of the cyst. Elevation of the right dome of diaphragm may be suggestive of hepatic hydatid cyst. Ultrasound examination is the initial screening test. Ultrasound is also helpful during treatment monitoring while on medical treatment and also for postoperative follow up (6, 7). Based on Hassen Gharbi classification, WHO – IWG-E (World Health Organisation- Informal Working Group on Echinococcus) proposed a new classification reflecting the functional status of the parasite that facilitates the selection of treatment modalities (8) (Table.1)

CT scan is the best investigation to differentiate an infected cyst from an amoebic abscess or a pyogenic liver abscess. MRI scan shows the cyst adequately but offers no real advantage over the CT scan, however, it is important in monitoring skeletal and cardiac hydatid cysts (9). MR angiography is useful if the cysts are large and in close proximity to major vessels. MRCP is the excellent investigation for jaundiced patient with hepatic hydatid cyst. ERCP is indicated when hydatid cyst material is detected in common bile duct on Imaging techniques.

**Immunodiagnosis:**

Detection of circulating Echinococcus granulosus antigen is less sensitive than the detection of antibodies. Hence, the Immunodiagnosis in Hydatidosis is based on the reaction between the test antigen and the circulating antibody in the host. The quality of the test antigen determines the sensitivity and the specificity of the test (10).

The intradermal Casoni test, the human basophil degranulation test and the complement fixation test are only of historical importance.

The primary tests for antibody detection are the following tests. 1. ELISA. 2. IHA antibody test.3.Latex agglutination test. 4. Immuno fluorescence antibody test. Immuno electrophoresis test. These primary tests have sensitivity of 80 to 95% in liver hydatid cyst, 65% in pulmonary hydatidosis. These primary serological tests are always interpreted in correlation with epidemiological data, clinical presentation and imaging investigations. However, the confirmation is by secondary tests which are more specific and of course more expensive and are available in only specialsed centers. These secondary tests are: 1. Detection of precipitation line at arc 5. 2. Identification of immunoglobulin G- subclass. 3. Immunoblotting. 4. PCR. In general, indirect haemagglutination test and ELISA are the initial screening tests of choice. Detection of antibodies to antigen 5 provide specific confirmation. Normally, postoperative seronegativity is reached after 3 to 7 years. Persistent raised antibody titers and positive secondary are indicators of recurrence.

**Management:**

WHO informal working group on Echinococcus (WHO-IWG-E) 2009 reached consensus on an image based, stage specific approach which helps in choosing one of the following treatment options (8). 1. Open surgery. 2. Percutaneous treatment. 3. Chemotherapy. 4. Watchful monitoring.

**Open Surgery:**

Surgery remains the primary treatment and the only hope for complete cure. In open surgery, the cyst is isolated. “Graduated dilution technique” is used for the inactivation of the hydatid cyst by alternate aspiration of the hydatid cyst fluid and injection of a scolicidal agent into the cyst repeatedly. The exposure time for the scolicidal agent is 10 minutes (11). Then the cyst is excised carefully without spillage or rupture. If the cyst is infected, suction drainage is applied after the cyst excision. If there is a biliary communication, close the communication with the absorbable suture followed by suction drainage (12). If the cyst is unresectable completely, partial resection of the cyst is done to decrease the parasitic load to aid the chemotherapeutic agents to act (13).The residual cavity is closed with absorbable sutures after filling up with saline or omentum. If the cyst wall is soft and pliable, either introflexion or captionnage is done. If the cyst is infected, either marsupialization or external tube drainage is done. Occasionally, Roux-en-Y cystojejunostomy or myoplasty using rectus abdominis or diaphragmatic muscle is done (14). Normally, the residual cavity disappears between 6 months and 18 months. If the cavity persists after 18 months, it requires diagnostic work up like ultrasonography, CT, MRI scans, serology and diagnostic puncture. If in doubt, reoperation is necessary (6).

In the era of minimal access surgery, laparoscopic treatment can be done ideally for Gharbi. Type I and Type II cysts (15, 16).

Percutaneous drainage of the cyst can be attempted if the cyst is very superficial in location in a solid organ like liver (17, 18, and 19).

If the surgical treatment is not feasible because of multiple cysts in multiple organs or the cysts are located in inaccessible areas, medical treatment is indicated.

## IV. Medical Treatment:

Benz imidazole derivatives: These are ovicidal, larvicidal and vermicidal agents.

Albendazole is administered at 10 to 15 mg/ kg body weight/day in two divided doses along with fat rich meal for a month followed by 14 day drug free interval. The complete course is given over a period of six months. It decreases ATP production in parasite causing energy depletion resulting in immobilization and finally the death of the parasite occurs.

Mebendazole is administered at 40 -50 mg /kg body weight/day over a period of six months. It causes death of the parasite by selective and irreversible blocking of uptake of glucose and other nutrients in adult parasite.

Iso-Quinoline pyrozine derivatives:

Praziquantel, a synthetic derivative is given at a dose of 40 mg/ kg body weight/ week. It increases cell membrane permeability resulting in a loss of intracellular calcium causing massive contraction and paralysis of parasite musculature and disintegration of cell wall.

In Echinococcus multilocularis infestation, the medical treatment is given for two years. Young people respond better with medical treatment. Medical treatment is given for 4 days prior to surgery and for a month postoperatively if surgery is contemplated.

By ultrasound imaging, if the cyst is detected to be inactive or dead as in Gharbi Type IV and Type V, watchful monitoring is practiced.

**HOW TO PREVENT?**

In addition to health education and proper disposal of offal, treatment of pet dogs in endemic areas for intestinal echinococcosis with Praziquantel 5 mg/ kg body weight is given periodically to prevent hydatidosis. Though there is a vaccine against cystic echinococcosis but there is no vaccine against multilocularis in veterinary practice (20). Boiling liver and lung that contain hydatid cysts for 30 minutes has been proposed as a simple efficient and energy and time conserving ways to kill the infective larvae.

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