



ECHINOCOCCOSIS

Three species of *Echinococcus* produce disease in humans and other animals: *E. granulosus*, *E. multilocularis*, and *E. vogeli*. Each produces a characteristic pattern of disease: 1) unilocular or cystic hydatid disease, 2) multilocular or alveolar hydatid disease, and 3) polycystic hydatid disease, respectively.

ECHINOCOCCOSIS DUE TO *E. GRANULOSUS*

(Unilocular echinococcosis, cystic hydatid disease)

1. **Agent:** *Echinococcus granulosus*, a small tapeworm of dogs.
2. **Identification:** The tapeworm *E. granulosus* is the most common species of *Echinococcus*. Hydatid cysts enlarge slowly, requiring several years for development. Developed cysts generally are 1-7 cm in diameter, but may exceed 10 cm.
 - a. **Symptoms:** Infection may be asymptomatic until cyst causes noticeable mass effect; then, signs and symptoms vary according to location, cyst size and number. Ruptured or leaking cysts can cause severe anaphylactoid reactions and may release protoscolices that can produce daughter cysts. Cysts are typically spherical, thickwalled and unilocular and are most frequently found in the liver and lungs, although they may also occur in other organs.
 - b. **Differential Diagnosis:** Differential diagnoses include malignancies, amebic abscesses, congenital cysts and tuberculosis.
 - c. **Diagnosis:** Species identification is based on finding thick laminated cyst walls and brood capsules as well as the structure and measurements of protoscolex hooks. Serodiagnosis is highly sensitive and specific.
3. **Incubation:** Variable, from 12 months to many years, depending on the number and location of cysts and how rapidly they grow.
4. **Source:** The prevalence of this parasite depends on the close association of humans and infected dogs. It occurs on all continents except Antarctica, but is especially common in grazing countries where dogs consume viscera containing cysts. In the USA, the tapeworm has been found in sheep-raising regions of Utah, Arizona, New Mexico and California and exists in a sylvatic cycle involving wild ungulates such as moose and caribou in Alaska.
5. **Reservoir:** The domestic dog and other canids are definitive hosts for *E. granulosus*; they may harbor thousands of adult tapeworms in their intestines without signs of infection. Infected dogs begin to pass eggs approximately 7 weeks after infection. Most canine infections resolve spontaneously by 6 months, although adult worms may occasionally survive as long as 2-3 years. Dogs may be infected repeatedly. Herbivores, primarily sheep, act as intermediate hosts. Felines and most other carnivores are not suitable hosts for the parasite.
6. **Transmission:** Human infection, which often takes place during childhood, occurs directly with hand-to-mouth transfer of eggs after association with infected dogs or indirectly through contaminated food, water, soil or fomites. In some instances, flies have dispersed eggs after feeding on infected feces. The adult worms in the small intestines of canines produce eggs containing infective embryos (onco-spheres), which are passed in feces; these may survive for several months in pastures or gardens. When ingested by susceptible intermediate hosts, including people, eggs hatch, releasing oncospheres that migrate through the mucosa and are carried by the blood to various organs where they form cysts. Different strains of *E. granulosus* vary in their ability to adapt to various hosts (sheep, cattle, horse, camel, pig, moose) as well as their infectivity to humans. Eating viscera that contain hydatid cysts infects canines. Sheep and other intermediate hosts are infected while grazing in areas contaminated with dog feces containing parasite eggs.



7. **Communicability:** Not directly transmitted from person to person or from one intermediate host to another.
8. **Specific Treatment:** Surgical resection of isolated cysts. Mebendazole (Vermox®) and albendazole (Zente®) have been used successfully and may be the preferred treatment in many cases. If a primary cyst ruptures, praziquantel (Biltricide®), a protoscolicidal agent, reduces the probability of secondary cysts.
9. **Immunity:** Children are more likely to be exposed to infection because they are more likely to have close contact with infected dogs and are less likely to have adequate hygienic habits. There is no evidence that they are more susceptible to infection than are adults.



ECHINOCOCCOSIS DUE TO *E. MULTILOCULARIS* (Alveolar hydatid disease, multilocular echinococcosis)

1. **Agent:** *Echinococcus multilocularis*.
2. **Identification:** This is a highly invasive, destructive disease caused by the larval stage of *E. multilocularis*.
 - a. **Symptoms:** Clinical manifestations depend on the size and location of cysts. Cysts are usually found in the liver, and because a thick laminated cyst wall does not restrict growth, they continuously expand at the periphery producing solid, tumor-like masses. Metastases can occur, resulting in secondary cysts in other organs. Humans are an abnormal host and the cysts rarely produce brood capsules, protoscolices or calcareous corpuscles. Serodiagnosis using purified *E. multilocularis* antigen is highly sensitive and specific. The disease is often fatal.
 - b. **Differential Diagnosis:** As for *E. granulosus*. Often confused with hepatic cirrhosis or carcinoma.
 - c. **Diagnosis:** Diagnosis is often based on histopathology.
3. **Incubation:** Same as for *E. granulosus*.
4. **Source:** Distribution is limited to areas of the Northern Hemisphere: central Europe, the former Soviet Union, Siberia, northern Japan, Alaska, Canada and rarely the north-central USA. The disease is usually diagnosed in adults.
5. **Reservoir:** The adult tapeworms are restricted largely to wild animals such as foxes, although dogs and cats can be sources of human infection. Infected dogs begin to pass eggs approximately 7 weeks after infection. Most canine infections resolve spontaneously by 6 months, although adult worms may occasionally survive as long as 2-3 years. Dogs may be infected repeatedly. Intermediate hosts are rodents, including voles, lemmings and mice. *E. multilocularis* is commonly maintained in nature in fox-rodent cycles.
6. **Transmission:** By ingestion of eggs passed in the feces of Canidae and Felidae that have fed on infected rodents. Fecally soiled dog hair, harnesses and environmental fomites also serve as vehicles of infection.
7. **Communicability:** Not directly transmitted from person to person or from one intermediate host to another.
8. **Specific Treatment:** Same as for *E. granulosus*. Radical surgical excision is less often successful than in *E. granulosus*. For nonresectable cases, continuous treatment with mebendazole, and possibly albendazole, may prevent progression of the disease.
9. **Immunity:** Same as for *E. granulosus*.



ECHINOCOCCOSIS DUE TO *E. VOGELI* (Polycystic hydatid disease)

1. **Agent:** *E. vogeli*.
2. **Identification:** Rostellar hooks distinguish this species. The polycystic hydatid is unique in that the germinal membrane proliferates externally to form new cysts and internally to form septae that divide the cavity into numerous microcysts. Brood capsules containing many protoscolices develop in the micro-cysts.
 - a. **Symptoms:** Vary depending on cyst size and location.
 - b. **Differential Diagnosis:** Same as for *E.granu-losus*.
 - c. **Diagnosis:** Same as for *E. granulosis*.
3. **Incubation:** Same as for *E. granulosis*.
4. **Source:** Cases have been identified in Central and South America. Domestic hunting dogs that have fed on the viscera of infected pacas are the source of human disease.
5. **Reservoir:** The definitive host is the bush dog. Primary intermediate hosts are pacas, agoutis, and spiny rats.
6. **Transmission:** Same as for *E. granulosis*.
7. **Communicability:** Not directly transmitted from person to person or from one intermediate host to another.
8. **Specific Treatment:** Same as for *E. granulosis*.
9. **Immunity:** Same as for *E. granulosis*.

REPORTING PROCEDURES

Reporting and control activities are the same, regardless of the species of *Echinococcus* infection.

1. Reportable. (Title 17, Section 2500, *California Code of Regulations*).
2. **Report Form: OUTBREAK / UNUSUAL DISEASE REPORT (DHS 8554, 03/00 fillable)**

3. **Epidemiologic Data:** Place of birth, other countries or indigenous areas in which case resided or traveled extensively. Date of arrival to the USA. Any extensive contact during lifetime with mammalian animals.

CONTROL OF CASE, CONTACTS & CARRIERS

CASE:

1. Isolation: None.
2. Concurrent disinfection: None.
3. Quarantine: None.

CONTACTS: No restrictions.

CARRIER (ANIMAL):

1. In hyperendemic areas, control populations of wild and stray dogs. Treat remaining dogs with praziquantel (Biltricide®).
2. Control the movement of dogs from known enzootic areas.
3. Strictly control slaughtering of livestock.

PREVENTION-EDUCATION:

1. Educate the public at risk to avoid exposure to dog feces. Hand washing should be emphasized.
2. Interrupt transmission from intermediate to definitive hosts by preventing dogs access to uncooked viscera. This includes supervision of livestock slaughtering and safe disposal of infected viscera.
3. Incinerate or deep-bury infected organs from dead intermediate hosts.
4. Periodically treat high-risk dogs; reduce dog populations to the occupational need for them.
5. Field and laboratory personnel should observe strict safety precautions to avoid ingestion of tapeworm eggs.



DIAGNOSTIC PROCEDURES

Radiography, computerized tomography, and sonography. Serologic testing is available; consult the Public Health Laboratory. Definitive diagnosis in seronegative patients requires microscopic identification of specimens obtained at surgery or by percutaneous aspiration.