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Echinococcus Fact Sheet

What is *Echinococcus*?

Echinococcus is a genus of tapeworm. Two species of *Echinococcus* (*Echinococcus granulosus*, and *Echinococcus multilocularis*) are known to exist in Montana wildlife. *E. multilocularis* has been documented in coyotes (SeeSee et al., 1983 and SeeSee et al., 1993) and in foxes (SeeSee et al., 1993) in Montana for several years. *E. granulosus* is found almost worldwide, but adult *E. granulosus* has only been documented in Montana during the past few years. An article recently published in the Journal of Wildlife Diseases describes the prevalence of *E. granulosus* in wolves (definitive host) and ungulates (intermediate host) in Idaho and Montana (Foreyt et al., 2009). *E. multilocularis* and E. *granulosus* differ in morphology, and in the hosts that they infect.

The geographic distribution of *Echinococcus granulosus* types

There are two biotypes of *E. granulosus* in North America. The *northern biotype*, which has a canine definitive host and a cervid intermediate host, is thought to be the biotype found in Montana wolves. This biotype has been reported in moose, elk, caribou, white-tailed deer, wolves, coyote, and dogs in North America and Eurasia. In the Upper Peninsula of Michigan, a deer/coyote and a moose/wolf cycle has been observed. Infection with this biotype primarily results in development of cysts in the lungs, which often rupture and resolve with expulsion (Meltzer et al., 1956; Wilson et al., 1968). The second biotype (*domestic biotype*) is typically found in domestic dogs and domestic ungulates, especially sheep in the southwestern United States (Arizona, California, New Mexico, and Utah) (Foreyt et al., 2009).

The life cycle of *Echinococcus*

Echinococcus species require two hosts to complete their life cycle. The adult tapeworms live in the intestine of the *definitive host*, which is typically a canine. Adult tapeworms lay eggs that are excreted with the feces of the definitive host. In many cases, the definitive host does not suffer adverse effects, even with a relatively heavy parasite burden. The intermediate host becomes infected by ingesting eggs passed with the canine feces. The intermediate host is typically a rodent (in the case of *E. multilocularis*), domestic or wild ungulate (in the case of *E. granulosus*), or rarely a human. Once ingested, the eggs hatch in the digestive tract of the intermediate host. The eggs then enter the blood stream and are carried primarily to the lung, liver, or brain, where they develop into cysts containing immature forms of the parasite. The number of cysts that develop in an intermediate host ranges from one to many. A few cysts may not cause adverse effects in the intermediate host, but many cysts can cause illness, and may be fatal. The parasite life cycle is completed when the intermediate host dies and a carnivore consumes the organs containing parasite cysts. Adult tapeworms then develop in the intestine of the canine definitive host, and begin laying more eggs.

E. granulosus typically infects domestic dogs or wolves as definitive hosts, and wild or domestic ungulates as intermediate hosts. *E. multilocularis* primarily infects foxes, coyotes, or wolves as definitive hosts, and rodents as intermediate hosts. Each of these parasites can sometimes infect other animals and rarely humans.

Can humans become infected with *Echinococcus*?
Yes. There is some risk of humans becoming infected with *Echinococcus*. *Echinococcus* infection in humans can lead to development of cysts in organs such as the lungs, liver or brain, just as it does with other intermediate hosts. Cysts may develop over prolonged periods of time (10-15 years) before any clinical signs are evident. Treatment may involve surgical removal of cysts and treatment with anthelmintic medications.

How could a human become infected?
To become infected, a human must ingest parasite eggs, which are passed with the feces of an infected canine. Eggs could be ingested while consuming vegetation or drinking water that has been contaminated with infected feces. Humans may also become infected after handling contaminated canine scat or fur, and then transferring eggs to the mouth by touching the face or eating before adequate hand washing.

What happens when humans are infected with *Echinococcus*?
If an *Echinococcus* infection in a human occurs, it can result in a variety of symptoms that depend on the site of the infection (e.g. liver, lungs, or brain) (http://www.dpd.cdc.gov/dpdx/HTML/Echinococcosis.htm).

The *northern biotype* of *Echinococcus*, which cycles between canids like wolves, and ungulates like deer and elk, is present in Montana. While the risk of human infection resulting from the wolf-ungulate cycle in Montana is theoretically possible, it is highly unlikely (Foreyt et al., 2009). When human infection does occur with this particular biotype it is considered by some experts to be relatively benign (Rausch, 2003). Human cases caused by the *domestic biotype* of *E. granulosus* are also very uncommon, but do occur, especially in high-risk groups having close contact with sheepherding dogs in the southwestern United States (Arizona, California, New Mexico, Utah) (Foreyt et al., 2009). Utah has been reported to have the highest number of surgical human cases in the United States. From 1944-1994, 45 surgical cases were reported.

How do I minimize my risk of infection with *Echinococcus*?
There are several basic precautions that can minimize the risk of human infection with *Echinococcus*. Dog owners should not allow their dog to consume carcasses of wild or domestic ungulates. If your dog does have access to carcasses, talk to your veterinarian about an appropriate deworming strategy. Always wash your hands after handling a dog that has access to ungulate carcasses. When enjoying outdoor recreation, do not touch or disturb wolf, coyote, or fox scat. Hunters should wear gloves when field dressing a wolf, coyote, or fox carcass, and wash hands and forearms thoroughly, since they may have come into contact with contaminated feces or fur.

Where did the *Echinococcus granulosus* in Montana come from?
It is not known where the *E. granulosus* recently documented in Montana originated. One hypothesis is that the parasite was maintained at a low level in canids such as coyotes and dogs in the absence of wolves prior to wolf reintroductions in 1995 and 1996, and that the presence of wolves has amplified the parasite on the landscape (Foreyt et al. 2009). Another hypothesis is that *E. granulosus* was brought into Montana with transplantation of wolves from Canada into Yellowstone National Park (Foreyt et al. 2009). Transplanted wolves were treated with an

anthelmintic drug effective against *E. granulosus* prior to release, however, whether or not that treatment was 100% effective is not known.

Can *Echinococcus* infect domestic livestock?
Yes. As mentioned above, the *domestic biotype* of *E. granulosus* typically infects domestic sheep as an intermediate host. However, *E. granulosus* can occasionally infect domestic cattle and horses. A horse/dog cycle has been reported in Belgium, Ireland, Italy, Switzerland, the United Kingdom, Australia, and the United States (Maryland). A cattle/dog cycle has been reported in Belgium, Germany, South Africa, and Switzerland. A swine/dog cycle has been reported in Poland. Few cases have been reported in horses within the United States. In most cases, *Echinococcus* was an incidental finding during necropsy after death of the animal from another cause. Most of the infected horses had been imported from Europe; however the first documented case of *Echinococcus* in a horse that originated in the United States occurred in Maryland in 1993. Again, the horse died of unrelated causes, and the *Echinococcus* cyst was an incidental finding at necropsy. In mild infections, the intermediate host may show no signs of disease; however, severe infections could be fatal.

Can I be infected with *Echinococcus* by handling tissues of an elk with *Echinococcus* cysts in the lungs or liver?
No. Humans must ingest *Echinococcus* eggs to become infected. Only the larval stage of the parasite is found within cysts in ungulates. The adult tapeworms, which lay eggs that can infect humans, are found in the intestinal tract of canines.

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