TURJOEM
The Turkish Journal of Occupational / Environmental Medicine and Safety

The Turkish Journal of Occupational / Environmental Medicine and Safety

2018; Volume 3, Issue 1 Web: http://www.turjoem.com ISSN : 2149-471

IMPORTANCE OF ECHINOCOCCOSIS CONCERNING ANIMAL AND HUMAN HEALTH, PRESENT CONDITION, AND SOLUTION PROPOSALS IN TURKEY

ALI BILGILI[1], BASAK HANEDAN[2]

[1] University of Ankara, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Ankara, Turkey.

[2] University of Ataturk, Faculty of Veterinary Medicine, Department of Internal Medicine, Erzurum, Turkey.

Abstract

Considering the fact that a major part of diseases occurring in humans is caused by animals, food safety and sustainable food safety can be performed in an environment that animal health and welfare are secured and sustainable livestock raising is established. When taken into account the fact that animal health directly affects human health and animal products are unquestionably required for human nutrition, it is concluded that human health depends on animal health. In this context, echinococcosis, threating health in both animals and humans and causing an important economic losses, is known to be the most important zoonotic helminth infection and has a major health and economic impact in developing countries. For these reasons, in this report context, concise information was given about present condition, problems, actions to be taken and solution proposals concerning echinococcosis in Turkey.

Key words: Echinococcosis, Animal and human health, Problems, Solution proposals.

INTRODUCTION

Echinococcosis in humans and mammalian animals is a zoonotic disease caused by the larval stage of *Echinococcus* spp. In humans (intermediate host) *Echinococcus granulosus sensu stricto*, *E. equinus*, *E. ortleppi* and *E. canadensis* cause cystic echinococcosis. *E. multilocularis* causes alveolar echinococcosis. *E. vogeli* and *E. oligarthrus* cause polycystic echinococcosis [1]. Recently, the larval stage of *E. shiquicus* is found in Ochotona curzoniae, but it is not known whether it causes echinococcosis in humans [2]. In our country the most appeared form is cystic echinococcosis, followed by alveolar echinococcosis [3].

1. Present Condition

Echinococcosis is known as the most important helmintic zoonose threating health and causing economic loss in humans and animals [4,5].

E. granulosus sensu stricto G1 genotype infects foxes, palm civets, hyenas, and jackals [6] and *E. felidis* infects wild carnivores including lions and hyenas [7]. *E. granulosus sensu stricto*, *E. canadensis* and *E. ortleppi* circulate between dogs and livestock species [8]. *E. granulosus sensu lato* is determined to infect wild carnivorous species such as fox, jackal and wolf [9], and its intermediate hosts are determined to be antelope, deer and wild boar [10]. *E. granulosus sensu stricto* and *E. canadensis* are determined in domestic animals in Turkey [11].

1.1. Development of *Echinococcus* species

Definitive hosts harboring the adult egg-producing stage of *E. granulosus* are canines such as domestic and wild dogs, wolves, jackals, foxes, and raccoon dogs and felines such as lion, puma, and jaguar and hyenas. Intermediate hosts harboring the larval stage of cestode are various herbivores such as sheep, goat, cattle, water buffalo, camel, deer, roe deer, equids, and omnivores such as human, pig, wild boar, and mouse [6,7,12,13].

E. multilocularis responsible for alveolar echinococcosis in humans is frequently reported in Europe. Definitive host is red fox, domestic dogs, and domestic and wild cats. Humans and mice are intermediate hosts [14]. The adult worms shedding eggs in felines are low and bowel infections with these tapeworms are rarely determined. Red foxes, domestic dogs, and raccoon dogs are showed to shed many eggs of *E. multilocularis* [15]. However, Knapp et al. [14] reported that of 43 feces in cats 4 were positive for *E. multilocularis*. Intermediate hosts are affected from the interaction of human-wildlife [16].

The knowledge of human-wildlife interactions is important to the development of intervention methods for decreasing the risk of *E. multilocularis* infection and alveolar echinococcosis in humans. Delivery of feeds containing anti-parasitic drug for definitive hosts is one of methods to reduce infection risk. However, this method is difficult and expensive to control *E. multilocularis* for a long time and on a large scale [16]. Campaigns expressing the fact that foxes are not to fed or tamed and kept at a distance are one of preventive strategies [16].

Definitive hosts are infected by eating organs with cyst of intermediate host or organs infected with protoscoleces. Protoscoleces consumed by definitive host adhere to the small intestine and then develop into adult stages in a period about 4 to 7 weeks [1].

Gravid proglottids of *Echinococcus* spp. in definitive host are excreted in feces. Eggs are released from gravid proglottids. Eggs are shed to the environmental area via wind, water, and arthropods. Humans are infected with eggs via unwashed fruits and vegetables, and contaminated drinking water. Sheep, goat, cattle and water buffalo are infected with pasture plants contaminated with eggs [3].

Eggs consumed by intermediate host hatch in the small intestine. Released oncospheres penetrate the small intestine. They are located in the liver, lungs and other organs through blood stream, and form hydatid cyst or alveolar echinococcosis [1].

1.2. Distribution of *Echinococcus* spp. in Turkey

a) In animals

Distribution of *Echinococcus* spp. varies depending on the density of definitive hosts and intermediate hosts, interactions between domestic animals and predators, socioeconomic and cultural structures of humans, climatic conditions, and natural conditions.

In definitive hosts there may be 40.000-50.000 worms in serious infected dogs. It is known that each worm can produce 1000 eggs in two weeks and environment may be contaminated with millions of eggs in areas where carnivores are densely populated.

Echinococcosis exhibits wide distribution in Turkey, and dog and sheep biological cycle is generally appeared in parasitic epidemiology.

b) In Humans

Because echinococcosis is not notified disease before 2005, data regarding information of those years of Ministry of Health can be obtained from statistical data of hospitalized patients.

Average 2500 cases yearly according to the hospital data and average 10.000 to 15.000 yearly cases according to the data of Social Security Institution in 2008-2015 are treated according to the data of Ministry of Health in 2016.

The principle stage in combating echinococcosis and secret of success is kept under control of dogs having important roles in disease cycle. For these reasons, prevalence of echinococcosis in dogs should be known.

Table 1. Prevalence of echinococcosis in studies conducted in Turkey.

Province	CE Prevalence in Cattle, (%)	CE Prevalence in Sheep, (%)	References
Burdur	3.5	26.6	Umur, S., 2003 [22]
Kars	31.25	63.85	Gıcık et al., 2004 [23]
Kırıkkale	14.1	50.9	Yıldız and Tuncer, 2005 [24]

Afyon	29.47	-	Köse and Sevimli, 2008 [25]
Sivas	35.68	-	Acıöz et al., 2008 [26]
Van	20.65	56.48	Yılmaz et al., 2009 [27]
Erzurum	34.3	-	Balkaya and Şimşek, 2010 [28]
Kayseri	3	28	Düzlü et al., 2010 [29]
Kars	5.3	-	Demir and Mor, 2011 [30]
Van	38.5	46.4	Oğuz and Değer, 2013 [31]
Bursa	3.06	1.15	Yibar et al., 2015 [5]

Umur [22] reported echinococcosis prevalence with 26.6% in sheep, and 3.5% in cattle in Burdur province. Gıcık et al. [23] reported echinococcosis prevalence with 63.85% in sheep, and 31.25% in cattle in Kars province. Esatgil and Tüzer [32] reported echinococcosis prevalence with 3.5% in sheep, and 11.6% in cattle in Trakya province. Yılmaz et al. [27] reported echinococcosis prevalence with 56.48% in sheep, and 20.65% in cattle in Van province. Düzlü et al. [29] reported echinococcosis prevalence with 28% in sheep, and 3% in cattle in Kayseri province. The prevalence of echinococcosis is appeared to vary from 3% to 63.85% in sheep in various regions of Turkey [24,33,34]. The prevalence of echinococcosis was reported to be 25.9% in cattle slaughtered [34].

1.3. Diagnosis

Diagnosis in the animals

Carnivores infected with *Echinococcus* spp. hardly show no clinical signs. Diagnosis of echinococcosis in carnivores can be made by necropsy and feces examination. Gravid proglottids are generally excreted in feces, rarely adult worms. However, it is difficult to appear in feces because of small segments [17].

Diagnosis in Humans and Descriptions of cases

Echinococcosis in humans is diagnosed by imaging techniques [18]. Pre-diagnosis can be supported by serologic methods [19].

Clinical Description

Clinical signs of echinococcosis are associated with organs that it is located. Clinical signs may not appear in initial stage of the disease due to small cysts for many years. Upon enlargement of cyst, clinical signs appear according to its compression and location. Cysts are frequently in liver, and lungs, followed with spleen, peritoneum, kidneys, pancreas, bone, eyes, brain, heart, and ovaries [1]. Clinical signs regarding hepatic hydatid cyst disease are pain in right upper quadrant, nausea, vomiting, and icterus. Clinical signs regarding lung hydatid cyst disease are respiratory distress, coughing, and chest pain [20,21].

1.4. Treatment

Treatment of Definitive Host

Echinococcosis in cats and dogs is treated by arecoline hydrobromide, bunamidine hydrochloride, mebendazole, praziquantel, epsiprantel, niclosamide, nitroscanate and fospirate.

Treatment of Intermediate Host

In livestock animals such as sheep, goat and cattle, treatment of echinococcosis is of no significance via surgical interventions. Some drugs, such as albendazole, mebendazole, thiabendazole, cambendazole, fenbendazole, oxfendazole and praziquantel, are effective but those drugs cause residue problems in meat and milk and public health concerns. Thus, treatment with those drugs in intermediate hosts is of no significance.

Treatment of Humans

Human echinococcosis is treated by surgery, percutaneous drainage, and medical drugs [21].

1.5. Staff Condition

In Turkey diagnostic services of animal health are generally supplied with institute laboratories and university laboratories. Total 200 veterinarians in 8 directorates of institutes and provincial directorates serve for controls of echinococcosis. Diagnostic services are also supplied with health staffs in 20 special laboratories.

In our country services for human health regarding echinococcosis cases are provided by Institutions and Organizations of Ministry of Health. There are enough health staffs for these services.

1.6. Prevention and Combat of Echinococcosis

The prevention of biological cycle of *Echinococcus* spp. is key point in combating echinococcosis. This is achieved by control of dogs as definitive host that are main source of echinococcosis.

The following measurements should be implemented:

- Controlling dog population,
- Prevention of dog infection with tapeworm,
- Treatment trials for adult worms,
- Prevention of dogs to transmit the tapeworm.

1.7. Environmental Eradication

Control and eradication of echinococcosis in animals should be principally performed for the purpose of prevention of *Echinococcus* spp. transmission. By this means, control of echinococcosis in humans will be discussed. The following measurements for the eradication of echinococcosis should be taken.

- Duly dispose of organs and tissues infected with *Echinococcus* spp. via control of abattoirs,
- Slaughtering in licensed abattoirs,
- Control of food production facilities and selling places,

- Preparation of National Action Plan or Control Programme in company with Ministry of Food, Agriculture and Livestock for the purpose of control and eradication of echinococcosis in animals and implementing this plan,
- Enough budget allocation by Ministry of Food, Agriculture and Livestock for the control of echinococcosis in animals,
- Evaluation of inclusion of antiparasitic administrations for echinococcosis to annual vaccination programme by Ministry of Food, Agriculture and Livestock,
- Providing the cooperation and coordination among Institutions.

1.8. Activities of organizations or foundations to implement

Ministry of Interior

Catching stray animals, building a shelter or providing shelter establishment,

Recording stray animals and providing their care,

Spaying of stray dogs for controlling them,

Conducting an activity for ownership of stray animals,

Cooperation with related organizations and provision of contributions of non-governmental organizations,

Providing budget for these activities.

Ministry of Forestry and Watery Affairs

Provision of cooperating with non-governmental organizations,

Conducting the necessary activities for establishing animal shelters,

Conducting the necessary activities regarding echinococcosis in wildlife and contributing the activities planned,

Addition of legal arrangements regarding ownership of animals to Animal Protection Law, Making arrangements on prevention of stray animals to be abandoned on the street after their spaying by modifying in 5199 numbered Animal Protection Law.

Ministry of Food, Agriculture and Livestock

Prevention of illegal and uncontrolled slaughtering and providing slaughter of animals under the control of veterinarian,

Conducting training activities for the acknowledgement of animal owners, staffs in abattoir, and community,

Conducting the necessary activities for the treatment of dogs with echinococcosis,

Providing consultancy service and technical staff supporting to related organizations for catching stray dogs, housing, treatment, spaying, and vaccination conducted by Municipal Corporation and Non-Governmental Organizations.

Ministry of Health

Providing acknowledgement and awareness of community,

Strengthening the notification system regarding echinococcosis and its follow-up,

Offering in service training for health staffs,

Providing the cooperation with related organizations and health organizations.

Other Institutions and Organizations

It is thought that in training of community, contributions of Ministry of Education, Radio-Television Authority of Turkey, Office of Commander In Chief and Department of Religious Affairs are important.

2. Problems

- Frequency of domestic and wild animals as definitive and intermediate hosts in the area,
- Uncontrolled animal movements among regions and countries,
- Dispose of the organs infected with echinococcosis in unreasonable conditions of abattoirs, throwing these organs around the abattoirs, and infection of dogs walking around these places,
- That community is not enough informed or they cannot enough understand the subject importance,
- Transmission of feces contaminated with eggs to vegetables and fruits growing near the surface of the ground, and eating those without washing,
- Contamination of children's hands with dog's feces contaminated with eggs and then taking the contaminated hands to the mouth when playing in sandbox,
- Hand contaminaton with eggs on the dog's hair during contact with hand to a dog,
- Contamination of mouths and noses of humans with air of eggs in feces via wind or contamination of foods,
- Echinococcosis continues to be a problem due to many factors such as that serious eradication programmes are not conducted in our country, population of stray dogs is remarkable, farm animals are slaughtered as ruleless in rural areas, community is not trained for echinococcosis.

3. Solution Proposals

- Taking precautions for stray dogs in combating echinococcosis,
- It should be prevented that dogs consume organs infected with echinococcosis, and dogs should never fed raw meat. Dog is fed cooked food,
- Drug should be administered to dogs infected with adult worms. Prepatent period of cestode in dogs is 5 weeks. Gravid proglottids are excreted in feces 5 weeks after dogs eat organs with hydatid cyst. Dogs should be treated within periods of 5 weeks if they eat raw meat,
- Amending abattoirs and regular surveillances,
- Dispose under suitable conditions and control of veterinarian of organs with hydatid cyst during slaughter in abattoirs,
- Acknowledgement of community for echinococcosis before feast of sacrifice that slaughter is performed under uncontrolled conditions, and dispose of organs with hydatid cyst,

- Consumption of vegetables with leaf and fruits after they are well enough washed,
- Application of at least two test with high sensitivity in serological diagnosis of echinococcosis, and also if any disturbance occurs between two tests, application of advanced examinations should be performed,
- Creating awareness in community and taking preventive measures of community by traning community with related organizations to combat echinococcosis (especially giving information with regard to echinococcosis in the way that children can understand, and prevention of the children to play with stray dogs),
- Prevention and control programme legitimately against echinoccosis is required in country wide to prevent community from disease. Prevalence studies showing the extent of problem in the country would constitute the basis of this programme.

REFERENCES

1. Agudelo Higuita NI, Brunetti E, McCloskey C. Cystic echinococcosis. J Clin Microbiol. 2016; 54(3):518-523, https://doi.org/10.1128/JCM.02420-15.

2. Boufana B, Qiu J, Chen X, Budke CM, Campos-Ponce M, Craig PS. First report of *Echinococcus shiquicus* in dogs from eastern Qinghai-Tibet plateau region. China Acta Trop. 2013;127(1):21-24, https://doi.org/10.1016/j.actatropica.2013.02.019.

3. Türk Hidatidoloji Derneği. Kist hidatik nedir? http://www.hidatidoloji.org. Available Date: 25.05.2017.

4. Youssefi MR, Mirshafiei S, Moshfegh Z, Soleymani N, Rahimi MT. Cystic echinococcosis is an occupational disease? J Parasit Dis. 2016;40(3):586-590, https://doi.org/10.1007/s12639-014-0543-2.

5. Yibar A, Selcuk O, Senlik B. Major causes of organ/carcass condemnation and financial loss estimation in animals slaughtered at two abattoirs in Bursa province, Turkey. Prevent Vet Med. 2015;118(1):28-35, https://doi.org/10.1016/j.prevetmed.2014.11.012.

6. Carmena D, Cardona GA. Echinococcosis in wild carnivorous species: Epidemiology, genotypic diversity, and implications for veterinary public health. Vet Parasitol. 2014;202(3-4):69-94, https://doi.org/10.1016/j.vetpar.2014.03.009.

7. Hüttner M, Romig T. Echinococcus species in African wildlife. Parasitology. 2009;136(10): 1089-1095, https://doi.org/10.1017/S0031182009990461.

8. Carmena D, Cardona GA. Canine echinococcosis: Global epidemiology and genotypic diversity. Acta Tropica 2013;128(3): 441-460, https://doi.org/10.1016/j.actatropica.2013.08.002.
9. Wang Z, Wang X, Liu X. Echinococcosis in China, a review of the epidemiology of *Echinococcus* spp. Ecohealth. 2008;5(2):115-126, https://doi.org/10.1007/s10393-008-0174-0.
10. Abdybekova AM, Torgerson PR. Frequency distributions of helminths of wolves in Kazakhstan. Vet Parasitol. 2012;184(2-4):348-351, https://doi.org/10.1016/j.vetpar.2011.09.004.
11. Murphy TM, Wahiström H, Dold C, Keegan JD, McCann A, Melville J et al. Freedom from *Echinococcus multilocularis*: an Irish perspective. Vet Parasitol. 2012;190(1-2):196-203, https://doi.org/10.1016/j.vetpar.2012.05.009.
12. Eckert J, Gemmell MA, Meslin F-X, Pawlowski ZS (Eds). WHO/OIE manual on echinococcosis in humans and animals: a public health problem of global concern. World Organization for Animal Health (Office International des Epizooties), 2001, Paris, France, and World Health Organization, Geneva, Switzerland.
13. Romig T, Omer RA, Zeyhle E, Huttner M, Dinkel A, Siefert L, et al. Echinococcosis in sub-Saharan Africa: emerging complexity. Vet Parasitol. 2011;181(1):43-47, https://doi.org/10.1016/j.vetpar.2011.D4.022.
14. Knapp J, Combes B, Umhang G, Aknouche S, Millon L. Could the domestic cat play a significant role in the transmission of Echinococcus multilocularis? A study based on qPCR analysis of cat feces in a rural area in France. Parasite. 2016;23:42, https://doi.org/10.1051/parasite/2016052.
15. Kapel CM, Torgerson PR, Thompson RC, Deplazes P. Reproductive potential of *Echinococcus multilocularis* in experimentally infected foxes, dogs, raccoon dogs and cats. Int J Parasitol. 2006;36(1):79-86, https://doi.org/10.1016/j.ijpara.2005.08.012.
16. Hegglin D, Bontadina F, Deplazes P. Human-wildlife interactions and zoonotic transmission of *Echinococcus multilocularis*. Trends Prasitol. 2015;31(5):167-173, https://doi.org/10.1016/j.pt.2014.12.004.
17. Craig PS, Rogan MT, Allan JC. Detection, screening and community epidemiology of taeniid cestode zoonoses: cystic echinococcosis, alveolar echinococcosis and neurocysticercosis. Adv Parasitol. 1996;38:169-250.
18. Bulakçı M, Kartal MG, Yılmaz S, Yılmaz E, Yılmaz R, Şahin D, et al. Multimodality imaging in diagnosis and management of alveolar echinococcosis: an update. Diagn Interv Radiol. 2016;22:247-256, https://doi.org/10.5152/dir.2015.15456.
19. Sarkari B, Rezaei Z. Immunodiagnosis of human hydatid disease: Where do we stand? WJM. 2015;5(4):185-195, https://doi.org/doi.org/10.5662/wjm.v5.i4.185.

20. Pakala T, Molina M, Wu GY. Hepatic echinococcal cysts: A review. J Clin Transl Hepatol. 2016;4(1):39-46, https://doi.org/10.14218/JCTH.2015.00036.
21. Mandal S, Mandal MD. Human cystic echinococcosis: epidemiologic, zoonotic, clinical, diagnostic and therapeutic aspects. Asian Pacific Journal of Tropical Medicine. 2012;5(4):253-260, https://doi.org/10.1016/S1995-7645(12)60035-2.
22. Umur S. Prevalence and economic importance of cystic echinococcosis in slaughtered ruminants in Burdur, Turkey. J Vet Med B Infect Dis Vet Public Health. 2003;50(5):247-52, https://doi.org/10.1046/j.1439-0450.2003.00667.x
23. Gıcık Y, Arslan MÖ, Kara M, Köse M. Kars ilinde kesilen sığır ve koyunlarda kistik ekinokokkozin yaygınlığı. Turkiye Parazitol Derg. 2004;28(3):136-139, https://doi.org/10.5152/tpd.2017.4833.
24. Yıldız K, Tunçer Ç. Kırıkkale'de sığırlarda kist hidatik'in yayılışı. Turkiye Parazitol Derg. 2005;29(4):247–250.
25. Köse M, Sevimli FK. Prevalence of cystic echinococcosis in slaughtered cattle in Afyonkarahisar. Turkiye Parazitol Derg. 2008;32(1):27-30.
26. Acıöz M, Çeliksöz A, Özçelik S, Değerli S. Sivas'ta Nisan-Mayıs 2005 tarihleri arasında kesilen sığırlarda kist hidatik yaygınlığı. Turkiye Parazitol Derg. 2008;32(3):205-207.
27. Yılmaz H, Çiçek M, Cengiz ZT. The problem of cystic echinococcosis in Van province. Kafkas Univ Vet Fak Derg. 2009;15(4):607-610.
28. Balkaya İ, Şimşek S. Erzurumda kesilen sığırlarda hidatidozis ve fasciolosisin yaygınlığı ve ekonomik önemi. Kafkas Univ Vet Fak Derg. 2010;16(5):793-797, https://doi.org/10.9775/kvfd.2010.1597.
29. Düzlü Ö, Yildirim A, Sariözkan S, İnci A. Kayseri Yöresinde Üç Farklı Mezbahada Kesilen Koyun ve Sığırlarda Kistik Echinococcosis'in Ekonomik Önemi. Erciyes Üniv Vet Fak Derg. 2010;7(1):7-11.
30. Demir P, Mor N. Kars belediye mezbahasında kesilen sığırlarda kistik echinococcosis'in yaygınlığı, mevsimsel dağılımı ve ekonomik önemi. Turkiye Parazitol Derg. 2011;35:185-188.
31. Oğuz B, Değer S. Van belediye mezbahasında kesilen sığır ve koyunlarda *Taenia hydatigena* sistiserkozu ve kistik ekinokokkoz. Turkiye Parazitol Derg. 2013;37:186-189.
32. Esatgil MU, Tüzer E. Prevalence of hydatidosis in salughtrered animals in Thrace, Turkey. Turkiye Parazitol Derg, 2007;31(1):41-45.
33. Arslan MO, Umur Ş. Erzurum mezbahalarında kesilen koyun ve sığırlarda hidatidozun yayılışı ve ekonomik önemi. Kafkas Üniv Vet Fak Derg. 1997;3(2):167–171.
34. Özçelik S. Cystic echinococosis and echinococcosis in Turkey. 20th International Congress of Hydatidology, 2001, RT9, 69, 4–8 June, Kuşadası, Turkey.