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Seroepidemiological Evaluation of Hydatid Cyst in Patients Visited in Qom Health Centers during 2007-2009

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Echinococcosis is a Zoonoses infection with worldwide spread. In some parts of Iran, the disease is endemic and is of great health and economic importance. With regard to the importance of the infection, the current study was carried out to determine the three-year prevalence of hydatidosis in Qom province. The test used was routine serological tests including ELISA method. The participants' personal information was collected using a questionnaire, and analyzed with SPSS software. It was observed that in the three years of study, the prevalence did not have a stable trend in different months and years. It was found that the disease mostly occurred in Iranians, households, urban population, illiterate people, and the age range of 51-60. Moreover, no statistically sex difference was observed in the patients. Identification of epidemiological aspects of the disease is a health priority in control and prevention of the disease. The reported frequency of the disease indicates more attention by the health authorities of the region to identify the contamination resources and the transmission routes.

Key words: Seroepidemiological Evaluation, Hydatid Cyst, Qom, Iran.

Echinococcosis is a zoonoses infection with worldwide spread. The larval stage (hydatid) is caused by cestodes of the genus *Echinococcus* (taeniidae family). The disease is certainly one of the main parasitic infections around the world.

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The larval infection of hydatid disease is caused by the growth of metacestode cysts in intermediate hosts. Through the parasite's life cycle, there are intermediate and definitive hosts, both of which are mammalians. The mature cestodes live in the small intestine of carnivores (definitive host) and produces eggs that contain contaminating oncosphere. When these eggs are released in the environment, they lead to contamination of man's environment. General health and economic status are important factors in being infected by echinococcosis. Recent

studies have shown that *Echinococcus granulosus* have been reported in at least 100 countries, especially in those where raising livestock is common. The disease is also endemic in some regions of our country[1-5]. The hydatid cysts are developed in different organs of intermediate hosts, including human. The clinical signs are different with respect to the site of cyst development in each organ. One of the notable clinical characteristics of cystic echinococcus is that the infection may be completely asymptomatic. The clinical signs are dependent on the size, number, and site of cyst development. Nevertheless, the early stages of the infection can sometimes be asymptomatic, and remain in this state for many years[6,7]. Hydatidosis is one of the diseases of tropical and semi-tropical areas. The infection has been reported in Mediterranean countries, Russia, Middle East, Far East, Australia, New Zealand, America, and Africa; and leads to considerable health and economic lost each year. Since there are different climates in Iran, the rate of the infection is different in various parts of the country. In the annual report of human infection cases from different provinces of the country, the highest and lowest infection rates have been reported from Khorasan and Hormozgan, respectively. Furthermore, the overall rate of infection in the country has been determined to be 1.2 cases per 100,000 populations[8,9]. Hydatid cyst is not a common disease in human. But because of its potential dangers and the difficulties in its treatment, it is a health problem in many countries. The region studied is susceptible to be contaminated by the disease, owing to its tourism position, as well as the immigrants living in the region and also its climate, agriculture, and livestock raising conditions. Therefore, the aim of the current study is to clarify the state of problems resulted from hydatidosis and accurate identification of the disease epidemiology. This data would help the authorities to adopt appropriate control and prevention strategies of the infection in order to reduce the number of infected individuals.

MATERIALS AND METHODS

This cross-sectional descriptive-analytical study was performed with random sampling in nine health centers of Qom province (Emam-Khomeini, Emam-Hassan-Askari, Al-Zahra, Jafarieh, Haji-Abad, Dastjerd, Masjed-Jame', Markazi, and Kahak). A 3-ml blood sample was obtained from each participant and their demographic data was recorded in a questionnaire. To perform the ELISA test, the first, second, and third wells were used as blank, and negative and positive samples, respectively. For other wells, 100 µl of the serum sample with 1:101 dilution was added and then the wells were incubated at room temperature for 30 minutes. After washing and adding of 100 µl of human anti-IgG conjugated antibody to peroxidase, the samples were kept at room temperature for 30 minutes. Again after washing 100 µl of dying solution to each well, the samples were incubated for 15 minutes in darkness. Photoabsorption of each well was determined using ELISA reader with 450-nm filter. The photoabsorption values of all wells were read against the blank sample. The test evaluation was as follows: photoabsorption value less than 0.1 was significant for blank well, and if the value was higher it was possible that the dying solution was contaminated. The mean value of photoabsorption for negative control was cut-off value of +0.25. The samples with photoabsorption of 10% above the cut-off value were considered to be positive for specific IgG against echinococcus, and samples with photoabsorption of 10% below the cut-off value were considered to be negative. The samples with photoabsorption value between 10% below and above the cut-off value were considered suspicious and the test was again performed on fresh serum samples three weeks later. If the photoabsorption value was again in the mentioned interval, the sample was considered to be negative for specific IgG against echinococcus[10]. The data obtained from the tests and demographic data of patients were analyzed using chi square and t-test.

RESULTS

The frequency of hydatidosis in 2008 was increasing compared to 2007. However, the trend was decreasing in 2009. The number of cases of cyst infection in Qom province was 7, 11, and 5 in 2007, 2008, and 2009, respectively. The cyst frequency was different in various months. In 2007, the frequency rate was 29% and 14% in April and

May, and then the rate decreased. The rate was 14% in August, and a peak of frequency was observed in February 2008, by 42%. Variations of disease report was also observed in 2008 and 2009, and the frequency peak of 2009 was observed in August (40%). The frequency of hydatidosis according to the living place shows that the disease rate was higher in the urban population in the three years of study. Regarding the sex distribution, the frequency rate was higher in women (65%). However, the frequency distribution did not show statistically significant difference between the two sexes (p= 0.435). Considering the frequency of infection in different age groups, the highest prevalence was observed in the 51-60 and then 21-30 age groups, while the lowest prevalence was observed in 11-20 (5%). Frequency of hydatidosis in people of different nationalities showed that the highest prevalence was in Iranian and then Afghan people. In 2007, the frequency in Afghans was 3.14%, which was decreasing in following years, and reached zero in 2009. Evaluating the frequency of hydatidosis in different jobs showed that most patients were households and the frequency in other jobs was variable in different years. In 2007, after households, the highest prevalence was observed in shepherds and herdsmen. This is while in 2008 and 2009, other jobs took the place. It should be mentioned that in the study, most infected individuals were illiterate (76%) and there was a statistically significant relationship between illiteracy and being infected by the disease. The frequency of the infection caused by contact with dogs had a decreasing trend from 2007 to 2009 (from 57.1% to 20%). In years other than 2007, the underlying cause of most cases was not specified. The results of the questionnaire in 2007 found a statistically significant relationship between contact with dogs (37%) and being infected with the disease.

Table 1. Correlation between agents of hydatid cyst transmission, demographic features and treatment methods among cases during 2007-2009

Characteristics		2007	2008	2009
Agent of transmission	Dogs	28.6	27.3	20
	Vegetables	42.9	27.3	60
	Other	28.6	45.5	20
Treatment	Surgical	86	64	80
	Medical	14	27	20
	Both	0	9	0
Nationality	Iranian	85.7	90.9	100
	Afghans	14.3	9.1	0
Sex	Male	40	36.4	28.6
	Female	60	63.6	71.4
Contact Situation	Contact with dogs	42.9	72.7	80
	Not specified	57.1	27.3	20
Birth Location	Urban	85.7	81.8	100
	Rural	14.3	18.2	0
Location	Liver	71	64	80
	Lungs	14	9	20
	Spleen	0	18	0
	etc	15	9	3
Age's group	11-20	0	0	0
	21-30	29	18	0
	31-40	14	9	0
	41-50	29	0	0
	51-60	14	27	80
	61-70	14	9	20
	71-80	0	18	0
	81-90	0	18	0

Considering the frequency of hydatidosis and contamination resources, in 2007 and 2009 the most common resource was vegetables; while in 2008 the most common source was not specified. The results obtained from the questionnaire indicated that in 2007 and 2009, using vegetables and being infected by the disease had a statistically significant relationship; such that most patients (75%) were those who used vegetables without washing it with saline or disinfectant solutions. In the three years of study, the most common sites of cyst involvement were liver, followed by lungs and spleen.Considering the type of treatment, the most frequently used treatments were surgical and then medical treatments. Furthermore, the clinical symptoms of the patients were valuated and it was observed that abdominal pain was the most

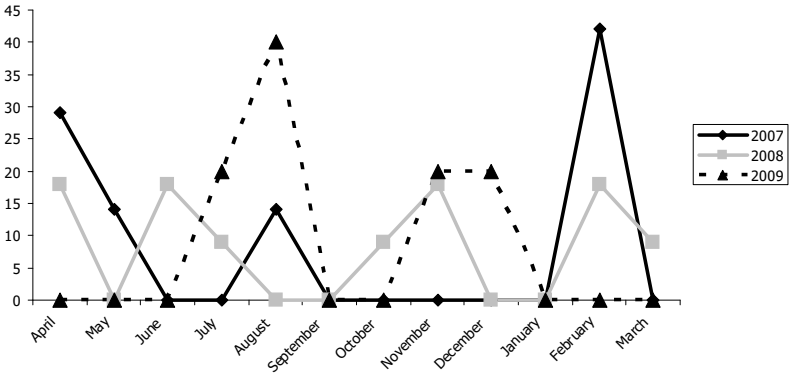

Fig. 1. Number of cases collected during 2007-2009

common symptom and cause of clinical visits. The symptom was observed in 82 individuals (57%). Other common clinical symptoms were nausea (76 cases, 53%), vomiting (52 cases, 36%), headache (41 cases, 28%), cough (28 cases, 20%), dyspnea and chest pain (20 cases, 14%), weight loss and decreased appetite (18 cases, 13%), and voiding problems (11 cases, 8%) (Table 1, Fig. 1).

DISCUSSION

Hydatid cyst disease is one of the important parasitic zoonosis diseases in different parts of the world, including Iran. The disease is caused in man and herbivores animals by larval cestodes of canidae, *Echinococcus granulosus*. By swallowing the eggs of the parasite with vegetables and contaminated water, and contact with infected dogs, man acquires the infection as the intermediate host. The infection usually involves liver and lungs; however, other organs such as brain, spleen, kidneys, and bone marrow can also be involved by the cysts. The clinical and pathological symptoms and signs of the disease depend on the site, size, and the space-occupying effect of cysts[11-13]. Considering the worldwide spread of the infection and its high economic impact for different countries, including Iran as an endemic country for the disease, and also lack of current comprehensive studies in the region, the current study was performed.

In Khuzestan province, Rafie' *et al.,* reported the disease frequency to be 1.8%. Also, Sarkari *et al.,* reported the value to be 1.8% in Yasuj. The rate was reported to be 8.8% by Moazezi *et al.,* In 2006, Sarvi *et al.,* reported the infection prevalence to be 1.6% in Tehran[14-17].The frequency of infection determined by ELISA was reported to be 7.7%, 4.4%, and 5.2% in Jordan, Argentina, and Mongolia, respectively[18-20]. The results obtained in the current study did not show significant sex difference. Evaluation of epidemiological indices showed the risk of infection to be the same for men and women. The results obtained in this respect are consistent with those reported in a study with IEP method in Iran in 2001, in which no sex difference was obtained for the infection. The infection rate was reported to be 5.1% and 4.4% for men and women, respectively, in Chahr-Mahal-o- Bakhtiari province in 2003, which were not significantly different. The rates were reported to be 5.6% and 5% for women and men in China,

respectively. In Mongolia, the highest prevalence was observed in the age group above 60. In the study carried out by Mirzanezhad-Asl *et al.,* in Kurdistan, it was shown that the highest prevalence of the infection was in the age range of 40-59[20-23]. The highest prevalence in the current study was observed in the age range of 51-60. Considering the chronicity of the disease and its prolonged prodromal phase, the infection is diagnosed and then treated in higher age ranges. However, the infection possibly occurs in childhood. The risk of infection relies on factors such as personal hygiene and health condition, cultural circumstances, and also socioeconomic properties. Comparing the infection rate of individuals in 2007 and 2009 with respect to the type of washing vegetables, it was observed that the infection rate was higher in individuals who do not wash vegetables with detergent or saline solutions and eat the vegetables unwashed. The higher prevalence of infection is caused by lack of adequate education for washing the vegetables and also economic reasons. According to the observations, the method of washing vegetables and its consumption was not hygienic and most people in the region studied used vegetables in raw form without appropriate washing. The results are in agreement with the findings reported by Mirzanezhad-Asl *et al.,* in Kurdistan. A study in Jordan showed that eating raw and unwashed vegetables as well as the site of cultivation of vegetables contaminated by the parasite increases the risk of infection in man[23, 24]. According to the results, the highest rate was observed among households. This is consistent with the findings of Akhlaghi *et al.,* and Baharsefat *et al.,* (25, 26). In 2007, after households, the highest prevalence was observed among shepherds and herdsman, which can be attributed to contact with contamination resources such as soil, vegetables, dogs, Canidae, and sheep. A reason for higher prevalence of the infection in shepherds can be stated as follows: since dogs stay near herds and shepherds, the parasite eggs transmit from dogs to shepherds more easily. On the basis of our results, contact with dogs was an important factor in being infected by the parasite in 2007. In the study carried out in 13 provinces of Iran, the prevalence of echinococcus granulosus in herd dogs was 22.1%. The dogs wandering freely in the region studied, and their possible entrance to the yards and getting close to the people can be an unwanted cause of exposure of people to the infection[24]. With regard to the residence place of infected individuals, a significant difference in the rate of infected individuals living in urban and rural areas was observed. In the study carried out by Gebreel *et al.,* in Libya, no statistically significant difference was observed between urban and rural populations. Khalili *et al.,* reported a higher prevalence of the infection in people living in rural areas, and the difference observed was significant[27-29]. In the current study, a higher prevalence was observed in urban population. The difference in the results of the current study with those of others can be explained by the difference in the combination and geography of populations studied, their economic status; and the general economic, climate, and background conditions of the region. Production of vegetables in the outskirts of cities and the poor knowledge of people about the transmission routes of the infection are other causes to be concerned. The findings indicated that most patients were illiterate and there was a statistically significant relationship between illiteracy and being infected by the disease. In the study fulfilled by Galdame, there was a statistically significant difference between the patient group and general population with regard to illiteracy factor. Furthermore, in Baharsefat *et al.,,*'s study, most patients were illiterate[26, 30]. The most common organ to be involved by the cysts in the current study was liver, which is consistent with the findings of Sarkari *et al.,* who reported involvement rate of 80% for liver[15]. With regard to the treatment, surgical, medical, and then combination of surgical and medical treatment were used most frequently. In the study by Khalili *et al.,,* in Chahar-Mahal-o-Bakhtiari, 13 cases of patients (9%) were found with the history of surgery for hydatid cyst, which was similar to those reported by Sarkari *et al.,,* and Dolat-Abadi *et al.,,* Although these results can be explained by the disease recurrence or acquisition of new infection, it indicates the importance of the disease as well as peri-surgical cares for inactivation of protoscolices of the parasite during the surgery and complete removal of the cyst[15, 30, 31]. Considering the clinical symptoms observed, our findings were in agreement with those reported by Khalili *et al.,,* They reported gastrointestinal

symptoms such as nausea and vomiting in more than half of the patients. This shows the importance of the symptoms for surgeons, infectious disease specialists, and general practitioners in early diagnosis of the disease (29). The study carried out in 19 patients with the history of surgery for hydatid cyst during 2004-2007 in Qom Province. According to the results, the highest prevalence was observed among women in the urban population with 31.57% infection. The results showed that the most patients were households in 21-30 age groups(32). In many parts of our country, a large portion of the population deals with animals such as dogs and herbivores, especially in traditional raising of livestock. Moreover, the dogs have simple access to the extra materials of slaughterhouse. Thus, many regions are considered by the World Health Organization (WHO) as hyperendemic regions.

CONCLUSIONS

Educating the people through mass media on the transmission routes of the disease and making them familiar with prevention measures as well as educating them the appropriate methods of washing vegetables, using wild plants, hygienic slaughtering of animals, and avoiding giving the organs of slaughtered animals to dogs as well as avoiding close contact with dogs can help decreasing the rate of infection in the country in future. It should be mentioned that positive results of serological tests does not definitively indicate the disease or existence of active cyst. Therefore, it is suggested that complementary tests such as sonography evaluations be performed to accurately identify the infected cases. This would help to define the spread and prevalence of the disease in the region.

REFERENCES

1. Zhang, W., Li, J., McManus, D.P. Concepts in immunology and diagnosis of Hydatid disease. *Clinical. Microb. Rev*., 2003; **16**(1): 18-23.
2. Kausch, A., Alessandro, A. The epidemiology of echinococcosis caused by *Echinococcus oligarthrus and E. vogeli* in the neotropics. In: Craig P, Pawlowski Z, Editors. Cestode Zoonoses:Echinococcosis an Emergent and Global Problem. The Netherlands, Amsterdam: IOS Press, 2002; 107-113.
3. Saebi, E. Helminthic diseases in Iran. Vol. 2, Helminthic diseases. Hayyan Publ. Tehran, 7th edition, 2003.
4. Eckert, J., Deplazes, P. Biological, Epidemiological, and Clinical Aspects of Echinococcosis, a Zoonosis of Increasing Concern. *Clinical. Microb. Rev*., 2004; **17**(1): 107-135.
5. Eckert, J., Gottstein, B., Heath, D., Liu, F.J. Prevention of echinococcosis in humans and safety precautions. In: Eckert J, Gemmell M A, Meslin F X, Pawlowski Z S, (Eds.). WHO/OIE manual on echinococcosis in humans and animals: a public health problem of global concern. *World. Org. Animal. Heal*., 2001; 238-247.
6. Carmona, C., Perdomo, R., Corbo, A. Risk factors associated with human cystic echinococcosis in Florid, Uraguay: results of a mass screening study using ultrasound and serology. *Am. J. Trop. Med. Hyg*. 1998; **85**: 599-605.
7. Morar, R., Feldman, C. Pulmonary Echinococcosis. *Eur. Respir. J.,* 2003; **21**: 1069-1077.
8. Schantz, P.M. Prarsitic zoonoses in prespective. *Int. J. Parasitol.,* 1991; **21**(2): 161-70.
9. Hadadian, M., Ghaffarifar, F., Dalimi, A.H., Roudbar, Mohammadi, S.H. Human hydatidosis seroepidemiology in Kordestan province usin ELISA in 2006**.** *Modarres. J. Med. Sciences.,* 2007; **10**(3-4): 13-8 [in Persian].
10. Mirzanejadasl, H., Fasihi Harandi, M., Deplazes, P. Serological Survey of Human Cystic Echinococcosis with ELISA Method and CHF Ag, in Moghan Plain, Ardebil Province, Iran. *Res. J .Biol. Sci.***,** 2008; **3**(1): 64-7.
11. Thampson, R.C.A. Echinococcosis. In: Gillespie SH, Pearson RD, editors. Principles and practice of clinical parasitology. New York: Wiley; 2001. p: 525-612.
12. Eckert, J., Gemmell, M.A., Meslin, F.X., Pawlowski, Z.S. (Eds.). WHO/OIE Manual on Echinococcosis in Humans and Animals: A Public Health Problem of Global Concern. *Office Inter Epizooties World. Heal. Org*., 2001; 20-71.
13. Nasrieh, M.A. Cystic echinococcosis in Jordan: socioeconomic evaluation and risk factor. *Parasitol. Resear*., 2003; **90**:456-466.
14. Rafiei, A., Craig, P.S., Hamzeiloyi, F. Seroepidemiological survey of Hydatic cyst in Khozestan province. 4th Iranian National Congress of Parasitology, Mashhad Medical Sciences University, 2003; P: 48 [in Persian].
15. Sarkari, B., Sadjjadi, S.M., Beheshtian, M.M., Aghaee, M., Sedaghat, F. Human cystic

echinococosis in Yasuj district in south-west of Iran. An epidemiological study of seroprevalence and surgical cases over a Ten-year period. *Zoon. Public. Heal. J*., 2009; **57**(2):146-50.

16. Moazezi, S.S., Fasihi, Harandi, M., Saba, M., Kamyabi, H., Sheikhzadeh, F. Sonographic and serological survey of hydatid disease in Rural regions of Shahdad and Chatroud, Kerman province, 2006-2007. *J. Kerman. Univ. Med. Sci*. 2009; **16**(1):25-34 [in Persian].
17. Sarvi, S.h, Akhlagi, L., Ormazdi, H., Dalimi Asl, A., Razmjo, A., Siavashi, M. Sero-epidemiological study of hydatic cyst in patients refer to Tehran Blood transfusion centers by Dot-ELISA method (2005). The sixth national and the first Regional Congress on parasitology and parasitic Diseases. 27-29 May, 2008 Karaj, Iran, P: 395 [in Persian].
18. Sadjjadi, M.S. Present situation of Echinococcosis in the Middle East and Arabic North Africa. *International. Parasitol*., 2006; **50**(1): S197-S202.
19. Coltorti, E.A, Fernandez, E., Guarnera, E., Lago, J., Iriarte, I. Field evaluation of an enzyme immunoassay for detection of asymptomatic patients in a hydatid control program. *Am. J. Trop. Med. Hyg*. 1988; **38**: 603–607.
20. Watson-Jones, D.L., Craig, P.S., Badamochir, D., Rogan, M.T., Wen, N.H., Hind, B.A Pilot serological survey for cystic echinococcosis in north-western Mongolia. *Annal. Tropl. Med. Parasitol.*1997; **91**(2):173-177.
21. Yousefi Darani H, Avijgan M, Karimi K, Manouchehri K, Masood J. Seroepidemiology of Hydatid Cyst in Chaharmahal va Bakhtiari Province, Iran. *Iranian J Publ Health*.2003; **32**(2):31-33
22. Togerson PR. The use of mathematical models to simulate control options for echinococcosis. *Acta Trop.*, 2003; **85**: 211-221.
23. Mirzanezhad-Asl, H., Fasihi-Harandi, M. Seroepidemiological evaluation of human echinococcus hydatid cyst using ELISA in Moghan plain. Scientific and Research *J. Ardabil. Uni. Med. Sci*., 2009; **9**(4): 334-346.
24. Eslami, A., Hosseini, H. Echinococcus granulosus infection of farm dogs of Iran. *Parasitol. Res*., 1998; **84**:205-208.
25. Akhlaghi, L., Massoud, J., Housaini, A. Observation on Hydatid Cyst Infection in Kurdistan Province (West of Iran) using Epidemiological and Seroepidemiological Criteria. *Iranian. J. Publ. Health.,* 2005; **34**(4): 73-5.
26. Baharsefat, M., Massoud, J., Mobedi, I., Farahnak, A., Rorkni, M.B. Seroepidemiology of Human Hydatidosis in Golestan Province, Iran. *Iranian. J. Parasitol.,* 2007; **2**(2): 20-4.
27. Arbabi, M., Dalimi, J.M., Sajadi, M. Seroepidemiological evaluation of human hydatid cyst in Hamedan in 1991. *Feiz. Quarterly*., 1998; **6**: 43-50.
28. Gebreel, A.O., Gilles, H.M., Prescott, J.E. Studies on the sero-epidemiology of endemic diseases in Libya. I. Echinococcosis in Libya. *Ann. Trop. Med. Parasitol*., 1983; **77**(4): 391-7.
29. Khalili, B., Shahrani, M., Moradi, M.T. Evaluation of ten-year prevalence of hydatid cyst patients who underwent surgery in hospitals of Chahar-Mahal-o-Bakhtiari province 1998-2007. *J. Shahr-e-Kord. Uni. Med. Sci*., 2010; **12**(1): 69-74.
30. Galdame, Z. Epidemiological variables associated with human hydatidosis in an asymptomatic rural population. *Parasitologial. Dia*., 1997; **21**(1/2): 7-13.
31. Doulatabadi, A., Kashi, A., Khalifeh soltani, A., Rafiee, M., Sistani, M., Valaei, N. A survey on clinical, diagnosis, treatment and relapse of hydatid cyst patients in Kashan District (1996-2004). *Feiz. Sci. Res. J*., 2005; **35**: 39-43 [in Persian].
32. Mardani, A., Babakhan, L., Abedi, F., Mardani, H, Epidemiological evaluation of patients with the history of surgery for hydatid cyst in Qom city hospitals during 2004-2007, *J. Lab. Med.,* 1388; **3**: 2 [in persian].