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Epidemiological Study of the Human Cystic Echinococcosis in Iran

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Abstract: This study examined official data on the incidence of human CE during the period 1999-2005 as case series study and studied routine hospital records in the main surgical hospitals in different provinces in Iran that were collected using a case report form. Human CE in 806 cases from 42 hospitals in 28 provinces of Iran was recorded. The highest CE rate was showed in Semnan Province. Females are more affected (54%). Infection was more in urban people (61%). Cases with age: 30-39 years old were the most infected (18.36%) and the highest rate of the infection to CE was showed in housewife people (47.77%). The majority of cysts were in the liver or lung. The liver (72.4%) was more involved than lung (18.1%), also cysts were found in the spleen (2.5%), abdomen (1.5%), brain (1.5%), both liver and lung (1%) and other organs (3%). 59.06% patients had a single cyst, 18.98% two cyst and in 21.96%, three cysts were found. Of these 806 cases, 58.56% had contact with dog in past. But there is no contact in 41.44%. Study on the probable origins of the infection to human CE was shown that vegetable was the most common (43.67%). For treatment of CE, 72.33% of patients had surgical interference, 12.90% of them received medical treatment and 14.77% of cases had both surgical and medical treatment. Finally, 99% of patients were cured and mortality in 1% of them cases was observed. Although human CE is endemic in Iran, it may control by a public health concern.

Key words: Cystic echinococcosis, hydatidosis, *Echinococcus granulosus*

INTRODUCTION

Human cystic echinococcosis (CE) is a chronic Zoonotic disease that results from infection with the larval stage of the dog tapeworm, *Echinococcus granulosus* (Eslami, 1997). Iran is surrounded by countries endemic for CE (Azlaf and Dakkak, 2006; Köse and Sevimli, 2008; Sadjjadi, 2006; Torgerson *et al.*, 2003). In human CE, the liver is the main organ affected, followed by lung tissue, however, there is usually no direct parasitological evidence for the presence of cysts in organs or tissues (Agayev and Agayev, 2008). With regard to slow progression of the cyst, patients with CE have no symptoms and they may only be discovered accidentally. Asymptomatic cases of abdominal hydatidosis may be revealed during ultrasonography (Frider *et al.*, 2001). On the other hand, economical losses are also very important and clinical management of CE has evolved over decades without adequate evaluation of important features such as efficacy, effectiveness, rate of adverse

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reactions, relapse rate and cost (Junghanss *et al.*, 2008). Iran can be divided climatologically into four different zones of which zone 4 (central and salt desert) is not convenient for animal breeding, but in spring to mild summer of zone 1 (Caspian Sea zone includes the Coastal plains and northern aspect of Alborz range) and zone 2 (Mountain Plateau zone includes the southern aspect of the Alborz and Zagros range) and also late winter and early spring of zone 3 (Persian Gulf Lowlands comprising the low altitude country bordering the Persian Gulf and extending northwards along the basin of the Tigris River bordering Iraq), there are suitable condition for animal breeding and the presence of parasites (Eslami, 1997). Therefore in Iran, the parasite is transmitted in a synanthropic cycle involving dogs and livestock (sheep, goats, cattle, camels and equines) (Rokni, 2008). So, stray dogs in urban areas and free or roaming dogs in rural areas are the main definitive hosts (Dalimi *et al.*, 2002; Mehrabani *et al.*, 1999). The purpose of this study was to investigate the trends in reported cases of CE in different regions of Iran and gain a better insight into epidemiological factors associated with infection.

MATERIALS AND METHODS

All the official records for the No. of cases reported throughout Iran between 1999 and 2005. Records from 42 hospitals in 28 provinces of Iran were collected. All of records related to treated CE cases in hospitals of different provinces in Iran annually. Records in which the confirmed diagnosis of CE was made were recorded in terms of the age, gender, occupation of the patient, place of birth, contact with dog, probable origin of infection, cyst location and results of treatment process for all of cases. In addition the location and number of cyst in infected organ was noted. Diagnosis of CE is usually based on imaging techniques with serological confirmation. Also the main forms of treatment were surgery and chemotherapy (Ekrami, 1976). Hence criteria for assess the infected records were indicative imaging techniques (X-ray, ultrasound, CT scan or MRI) or positive serological tests (immunoelectrophoresis) along with treatment of the case with surgery and chemotrapy and histopathology records of cysts or aspiration fluid. The study was carried out on the whole of existed data and all of records were studied as case series study. Meanwhile, descriptive statistical method (Absolute and relative frequency) was used for analysis of data.

RESULTS

A total of 806 cases of human CE were recorded from 42 hospitals in 28 different provinces of Iran for the period 1999 to 2005. Semnan Province (central part of Iran) showed the highest CE rate (2.66%) and any CE case showed in Hormozegan Province (south of Iran, border of Persian Gulf) (Table 1, Fig. 1). Of the 806 CE cases in this study, 436 (54%) cases were female and 370 (46%) of them were male (Table 2). Rate of the infection to human CE in urban people was 61% and in rural was 39%. The highest rate of human CE was showed in age: 30-39 years old (18.36%) and the lowest, in age: 70-79 years old. In Table 3 was showed distribution of the infection to human CE base on age of cases and also presence of cyst in liver or lung and other organs. Occupations of the patients are shown in Table 4 on the basis liver or lung infection and also presence of infection in those alone or together with other organs. Related occupations were grouped together. T otally, of the 806 CE cases, 385 (47.77%) patients were housewife. The majority of the cysts were in the liver or lung. In 72.4% of CE cases, cyst was found in liver which in 62.5%, cyst was found only in liver but in other cases, cyst showed in other organs in addition to liver. Meanwhile, 146 patients (18.1%) had cyst in lung which in 21.2% of them, cyst was found only in lung and in other cases, cysts were found in other organs accompanying lung. Totally, hydatid cysts were found in 72.4% cases in liver, in 18.1% cases in lung, while they were also found in the spleen (2.5%), abdomen (1.5%), brain (1.5%), both liver and

Table 1: Comparison of different provinces of Iran based on incidence of human CE during the period 1999-2005

Province	Infection to hydatid cyst		
	Total frequency	Average of incidence	SD
Semnan	116	2.66	0.95
Chahar mahal Bakhtiari	132	2.07	1.15
Esfahan	549	1.69	0.64
Fars	450	1.40	1.10
Khuzestan	401	1.36	0.92
Ardebil	133	1.35	0.30
Hamedan	185	1.32	0.50
Khorasan	646	1.26	0.59
Lorestan	146	1.11	0.43
Markazi	97	0.93	0.52
Ilam	34	0.85	9.74
Kohgiluyeh and Boyer Ahmad	36	0.79	1.02
Ghom	28	0.60	0.28
Zanjan	69	0.56	0.61
Tehran	515	0.56	0.14
Kermanshah	78	0.52	0.28
Kurdistan	60	0.51	0.28
Ghazvin	23	0.48	0.31
East Azerbaijan	108	0.40	0.31
Gilan	72	0.37	0.10
West Azerbaijan	68	0.33	0.10
Mazandaran	77	0.29	0.10
Sistan and Balochestan	18	0.14	0.17
Yazd	8	0.13	0.22
Golestan	11	0.12	0.05
Boshehr	8	0.12	0.14
Kerman	6	0.03	0.04
Hormozegan	0	0.00	0.00

Table 2: Absolute and relative frequency distribution of human CE based on pivotal role of liver or lung infection on the basis of gender

	Liver		Liver with				Lung				Lung with				Total			
	Liver		one organ		two organs		Others		Lung		one organ		two organs		Others		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	215	58.1	18	4.9	2	0.5	135	36.5	100	27.0	15	4.1	1	0.3	254	68.6	370	100
Female	289	66.3	31	7.1	4	0.9	112	25.7	71	16.3	21	4.8	2	0.5	342	78.4	436	100
Total	504	62.5	49	6.1	6	0.7	247	30.7	171	21.2	36	4.5	3	0.4	596	73.9	806	100

Table 3: Absolute and relative frequency distribution of human CE based on pivotal role of liver or lung infection on the basis of age

Age (year)	Liver		Liver with				Lung				Lung with				Total			
	Liver		one organ		two organs		Others		Lung		one organ		two organs		Others		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0-9	30	48.4	6	9.7	0	0.0	26	41.9	21	33.9	4	6.5	0	0.0	37	59.7	62	100
10-19	40	40.8	5	5.1	1	1.0	52	53.1	40	40.8	4	4.1	0	0.0	54	55.1	98	100
20-29	80	55.2	14	9.7	1	0.7	50	34.5	37	25.5	11	7.6	1	0.7	96	66.2	145	100
30-39	105	70.9	9	6.1	2	1.4	32	21.6	20	13.5	6	4.1	1	0.7	121	81.8	148	100
40-49	90	69.2	7	5.4	1	0.8	32	24.6	19	14.6	6	4.6	0	0.0	105	80.8	130	100
50-59	75	70.8	4	3.8	0	0.0	27	25.5	16	15.1	1	0.9	0	0.0	89	84.0	106	100
60-69	57	71.3	3	3.8	1	1.3	19	23.8	13	16.3	2	2.5	1	1.3	64	80.0	80	100
70-79	27	73.0	1	7.2	0	0.0	9	24.3	5	13.5	2	5.4	0	0.0	30	81.1	37	100
Total	504	62.5	49	6.1	6	0.7	247	30.6	171	21.2	36	4.5	3	0.4	596	73.9	806	100

lung (1%) and other organs (3%). A single cyst was found in 476 (59.06%) patients, while 153 (18.98%) patients had two cysts and 177 (21.96%) patients had three cysts. Of these 806 studied patients, 472 (58.56%) cases had contact to dog as definitive host in past. Also in 334 (41.44%)

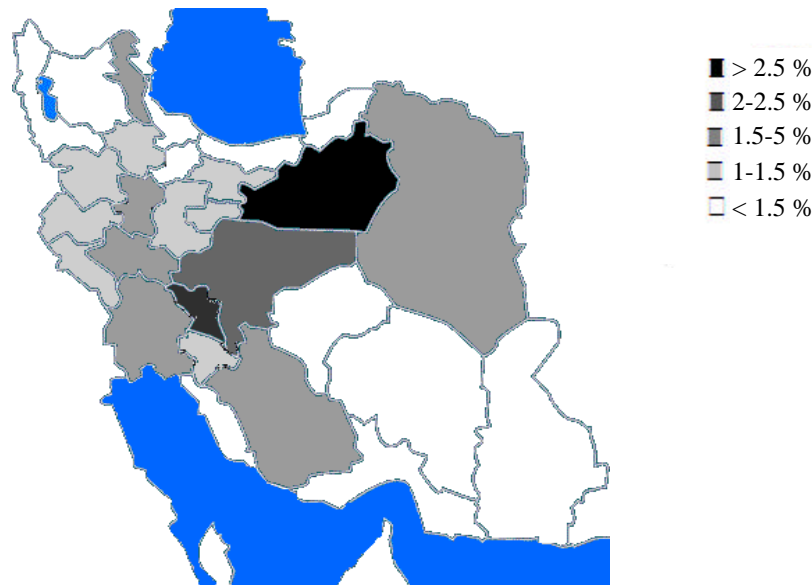


Fig. 1: The surgical incidence of human CE in different regions of Iran during the period 1999-2005

Table 4: Absolute and relative frequency distribution of human CE based on pivotal role of liver or lung infection on the basis of occupation

	Liver		Liver with one organ		Liver with two organs		Others		Lung		Lung with one organ		Liver with two organs		Others		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Unskilled worker	46	68.7	2	3.0	0	0.0	19	28.4	16	23.9	2	3.0	0	0.0	49	73.1	67	100
Student	34	36.6	6	6.5	1	1.1	52	55.9	41	44.1	6	6.5	0	0.0	46	49.5	93	100
Unemployed	13	76.5	0	0.0	0	0.0	4	23.5	3	17.6	0	0.0	0	0.0	14	82.4	17	100
Farmer	66	53.2	7	5.6	1	0.8	50	40.3	37	29.8	8	6.5	1	0.8	78	62.9	124	100
Officer Worker	37	63.8	4	6.9	0	0.0	17	29.3	14	24.1	1	1.7	0	0.0	43	74.1	58	100
Housewife	256	68.8	28	7.3	4	1.0	88	22.9	53	13.8	18	4.7	2	0.5	312	81.0	385	100
Free employment	40	71.4	2	3.6	0	0.0	14	25.0	6	10.7	1	1.8	0	0.0	49	87.5	56	100
Others	3	50.0	0	0.0	0	0.0	3	50.0	1	16.7	0	0.0	0	0.0	5	83.3	6	100
Total	504	62.5	49	6.1	6	0.7	247	30.6	171	21.2	36	4.5	3	0.4	596	73.9	806	100

Table 5: Absolute and relative frequency distribution of human CE based on pivotal role of liver or lung infection on the basis of contact to dog

	Liver		Liver with one organ		Liver with two organs		Others		Lung		Lung with one organ		Liver with two organs		Others		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Contact to dog	278	58.9	27	5.7	4	0.8	163	34.5	116	24.6	21	4.4	2	0.4	333	70.6	472	100
No-contact to dog	226	67.7	22	6.6	2	0.6	84	25.1	55	16.5	15	4.5	1	0.3	263	78.7	334	100
Total	504	62.5	49	6.1	6	0.7	247	30.6	171	21.2	36	4.5	3	0.4	596	73.9	806	100

patients, there is no contact to dog (Table 5). Also in this study, probable origins of the infection to human CE were studied. Data were showed that vegetable was probable origin of the infection in 352 (43.67%) patients (Table 6). Of these 806 cases of human CE, 583 (72.33%) people had surgical interference and cases had been confirmed pathologically, 104 (12.90%) cases received medical treatment and they were diagnosed base on serological tests and imaging techniques. In 119 (14.77%) cases received both surgical and medical treatment. Finally, after treatment process, 798 (99%) cases were cured and mortality in 8 (1%) cases was observed.

Table 6: Absolute and relative frequency distribution of human CE based on pivotal role of liver or lung infection on the basis of probable origin of infection

	Liver		Liver with one organ		Liver with two organs		Others		Lung		Lung with one organ		Liver with two organs		Others		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Dog	105	63.3	7	4.2	2	1.2	52	31.3	36	21.7	5	3.0	0	0.0	125	75.3	166	100
Vegetable	237	67.3	23	6.5	3	0.9	89	25.3	51	14.5	18	5.1	2	0.6	281	79.8	352	100
Unknown	58	63.0	2	2.2	0	0.0	32	34.8	23	25.0	1	1.1	0	0.0	68	73.9	92	100
Dog and vegetable	104	53.1	17	8.6	1	0.5	74	37.8	61	31.1	12	6.1	1	0.5	122	62.3	196	100
Total	504	62.5	49	6.1	6	0.7	247	30.6	171	21.2	36	4.5	3	0.4	596	73.9	806	100

DISCUSSION

Human cystic echinococcosis (CE) is one of the major zoonotic parasitic diseases in the Middle East and Arabic North Africa from Morocco to Egypt. Both cystic and alveolar echinococcosis has been reported from these areas. However, cystic echinococcosis is more prevalent and has been reported from all countries in the Middle East and Arabic North Africa. Alveolar echinococcosis is less prevalent and has been reported only from Iran, Turkey, Iraq and Tunisia (Sadjjadi, 2006). *Echinococcus granulosus* is highly prevalent in Iran, Turkey, Iraq, Morocco, Tunisia and Libya (Azlaf and Dakkak, 2006; Sadjjadi, 2006; Torgerson *et al.*, 2003). In the Levant countries, the cystic echinococcosis is also highly endemic. In Oman, it is endemic with low prevalence and a very low level in Cyprus (Sadjjadi, 2006). Various surveys have indicated that hydatid cysts are commonly found in sheep, cattle, goats and camels throughout these regions (Azlaf and Dakkak, 2006; Dalimi *et al.*, 2002; Daryani *et al.*, 2007). Sheep are the most infected animals of these regions. Most of studies on human have been focused on surgical reports although several population studies have been performed using serological and imaging techniques (Frider *et al.*, 2001; Sadjjadi *et al.*, 2001).

Present study was carried out to determine whether infection with CE represents a public health threat in some areas and to identify regions with high parasite transmission. Present data showed that the highest rate of the infection was in central part of Iran and the lowest was in southeast of the country. Several factors could account for this finding. Firstly, major hospitals of Iran located in central provinces. However, retrospective hospital survey data on human CE can not give an accurate picture of the prevalence of infection. A certain number of cases are not seen in hospitals because the infection is asymptomatic or does not require surgical intervention. Secondly, infected dog is the direct or indirect source of infection for humans and therefore, the prevalence of canine infection is one of the most reliable indicators of the potential danger to humans and probable of the canine infection in central provinces of Iran is more and it is related to suitable geographical conditions. Instead, in southeast of Iran, there is only dry deserts and no suitable condition for lifecycle of the parasite. The prevalence and distribution of *Echinococcus granulosus* in sheep dogs was studied in 13 provinces of Iran. Worms were found in 27.17% dogs. The highest prevalence was detected in dogs from the rural areas of Esfahan Province (central part of Iran) and the lowest, in dogs from those of Sistan and Balochestan Province (Southeast Iran) (Eslami and Hosseini, 1998). Also in Fars Province, one hundred and five stray male and female dogs in different age groups were autopsied and their small intestines examined for *Echinococcus granulosus*. Thirty eight dogs (36.19%) harboured two-to-several thousand *E. granulosus* in their intestinal content (Mehrabani *et al.*, 1999). Therefore these findings are similar to our results. In the other hand, infection was seen in other regions of Iran. The prevalence of human CE was reported in 4 areas of Khuzestan Province and the prevalence of CE was 13.8%: Behbahan (1.9%), Shoush (12.4%), Masjed Soleiman (17.3%) and Izeh (18.2%) (Rafiei *et al.*, 2007). Dog/sheep strain seems to be more prevalent in these regions of Iran (Sadjjadi, 2006).

In this study, female patients were more than male. This is similar to other studies in Iran (Mamishi, 2007), in the UK, the Middle East and North Africa (Torgerson *et al.*, 2003). This may reflect that women were more likely to seek treatment. The highest rate of human CE was showed in age: 30-39 years old. Bastani and Dehdashti (1995) also showed 60% of the patients were in the third and fourth decades of life. In study of Torgerson *et al.* (2003), analysis of data suggested that the likelihood of an affected patient having a cyst decreased with age. In the present study, cysts were found in 72.4% cases in liver, in 18.1% cases in lung, while they were also found in the spleen (2.5%), abdomen (1.5%), brain (1.5%), both liver and lung (1%) and other organs (3%). So, liver and lungs account for more than 90% of organ involvements and the most hydatid cysts were found in liver and lung, while they were also found in the spleen, abdomen, brain and other organs (Sadjjadi, 2006). Splenic involvement is rare occurrence of about 2.5% and in another study were reported two cases of hydatid disease of the spleen in Izeh, a city in Khuzestan Province of Iran (Azordegan *et al.*, 2007). Mamishi (2007) showed that cysts found in the lungs and livers of 24 (77%) and 15 cases (48%), respectively, with 8 cases (26%) having simultaneous liver and lung cysts. Three patients (10%) had multiorgan involvement. Meanwhile, cyst may find in unusual location. For example, in an Iranian Moslem patient cyst was found in ovary (Azhar, 1977). The striking clinical resemblance between hydatid disease and malignant diseases of some organs makes the correct diagnosis essential. In countries where this disease is endemic, any growing mass or tumour should arouse suspicion of hydatid disease (Emamy and Asadian, 1976).

In conclusion, this study proved highly useful in determining the incidence of hospitalized CE cases and these findings indicate that CE is a public health and an economic problem in Iran. There are reasonable grounds for presence of the infection. The infection in stray dogs and other carnivores, bad abattoirs, the frequent slaughter of animals in places other than abattoirs and illegal immigrations especially in eastern border of the country appear to be the main reasons for the high prevalence of echinococcosis in Iran.

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