Epidemiological trend of cutaneous leishmaniasis in two endemic focus of disease, south of Iran

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Abstract Cutaneous leishmaniasis is one the most important zoonotic diseases has different invertebrate hosts in different parts of its range, the vectors are often closely related. Leishmaniasis is a world-wide vector borne disease, affecting 88 countries: especially in the Middle East and southwestern Asia. *Nesokia indica* or *M. libycuserythraeus* are confirmed as reservoir and Phlebotomine sand flies are proven as vectors of the disease in the south of Iran. Patients' information collected from Firouzabad and Ghirokarzin county, Fars province in Iran during 2006–2014. Data analyzed by Chi square test using SPSS19 statistic software. 613 cases (61.91 %) lived in rural and 377 (38.08 %) lived in urban areas. All ages were grouped between 1 and ≥ 30 years. 479 (48.38 %) of patients being male and 511 (51.61 %) female. 39.49 % of patients were with dry lesions and 60.5 % were with wet lesions. Hand ulcers were the highest prevalence part of body (39.59 %). The common frequent size of lesions was lesser than 2 cm. Regarding the most prevalence rate (47.67 %) raised in autumn season. This study showed that cutaneous leishmaniasis was an endemic disease in Firouzabad and Ghirokarzin regions.

Keywords Cutaneous leishmaniasis · Sand fly · Fars province · Iran

Introduction

Cutaneous leishmaniasis is known as disfiguring disease which cause skin lesion in different members of body in human. Although efforts were continued to dominate CL disease but it is a serious challenge for countries that located in the WHO Eastern Mediterranean Region. More than 100,000 new cases of cutaneous leishmaniasis are reported annually to WHO by Countries in the Region which Iran country is also included in this district (World Health Organization 2014; Ashford 2000). Leishmaniasis is a world-wide vector borne disease, affecting 88 countries: 72 are developing countries and 13 of them are among the least developed. Also it is prevalent in over of 100 countries, from warm temperate through subtropical to tropical climates (Desjeux 1996; Ashford et al. 1992). This disease is one of the most important native diseases in Iran transmitted via the bite of sand fly in two kind of urban and rural. About 20 thousand cases of cutaneous leishmaniasis are annually reported from the various parts of Iran which it should be noted that the actual rate is several times more than the reported (Rassi et al. 2006; World Health Organization 2010). The prevalence of disease in the province of Khorasan, Fars, Isfahan, Khuzestan and Kerman provinces is high and the as Ilam, Bushehr and Yazd have been the highest frequency of cases recent years. In general, the highest incidence rate exists in the western provinces and northwest has the lowest incidence of Leishmaniasis in the country (Athari et al. 2006; Nadim et al. 1984). Zoonotic cutaneous leishmaniasis (ZCL) and anthroponotic CL (ACL) were occurred due to *Leishmania*

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major and *Leishmania tropica* in Iran (Yaghoobi-Ershadi et al. 2001). Fars province, South of Iran is known as endemic foci of CL and *Nesokia indica* or *M. libycuserythraeus* are confirmed as reservoir of ZCL disease (Rassi et al. 2001; Javadian et al. 1976). It should be collected information from epidemiological areas about aspects of causing factor of leishmaniasis to management and prevention of it. In order to we can be planed the best surveillance system to eliminate the neglected tropical disease with analyzing this data and rising knowledge. This research aids us to identify aspects of cutaneous leishmaniasis in two districts (Firouzabad and Ghirokarzin) of Iran.

Methods

Study area

The data information was collected from two districts from April 2006 to December 2014 (Fig. 1). Firouzabad County is ancient region that located 53°38'E; 28°26'N at an altitude of 1600 m above sea level in Fars province south of Iran. This district has 116,622 inhabitants living in an area of 3.8 km² and allocated 2.8 % of total areas of Fars province. It's a region which situated at a distance of 100 km of Shiraz, the center city of this province. The climate is moderate with the mean annual rainfall; relative humidity and annual temperature are 147.8 mm, 31 % and 23.1 °C respectively. The second district was Ghirokarzin (59°55'E; 28°19'N) is subdivided into two districts: the Central district and Efzar parts (population = 64,910) with 3.4 km². This county is adjacent to Firouzabad region and surrounded by Jahrom, Farashband, Khonj and Lar zones. The weather is hot with the mean annual rainfall; relative

humidity and annual temperature of Ghirokarzin are 136.4 mm, 35 % and 28.8 °C respectively.

Sampling and patients

This study was a descriptive cross-sectional consisted of 990 patients. The data of this investigation included the existing information which was confirmed in Health centers of Firouzabad and Ghirokarzin from 2006 until 2014. Patients' information as cutaneous leishmaniasis recorded into special forms in which classify by many features included the following: gender, age, place, seasonal transmission of disease, and type of lesion, size of lesion etc. Stained smear is diagnostic method was done by laboratory experts to identify cases. Patients were between 1 and >30 year. In vitro culture (Novy-Mac Neal-Nicolle) used for determination of leishmania species (Tables 1, 2). All patients were treated by Antimony therapy or cryotherapy methods. Then obtained information was analyzed by Chi square test using SPSS 19. The new molecular techniques are more sensitivity than others tests (Aviles et al. 1999; Hagardson 2006). Microscopic smear examination is so simple, fast and available for characterization of leishmania species (Lainson and Shaw 1987; Belli et al. 1998). In this survey used microscopic method, clinical features, culture, reservoir hosts, proven vectors and epidemiological aspects for classify of leishmaniasis (ZCL and VCL) (Rassi et al. 2006; Pearson et al. 2001; Bailey and Lockwood 2007).

Results

In this study 990 cases included (Firouzabad and Ghirokarzin areas) detected by laboratory experts and clinical methods as cutaneous leishmaniasis. 613 patients (61.91 %) lived in rural and 377 (38.08 %) lived in urban areas. 479 (48.38 %) of patients being male and 511 (51.61 %) female. 517 (52.22 %) of cases were under the age group of ≥20 years. Student, farmer, housekeeper, worker and employee were 22.92, 21.91, 20.80, 18.88 and 4.94 % of patients respectively. 10.50 % individuals had other occupations. 98.33 % cases were new and 1.67 % demonstrated infection after much times. On the other hands these cases had been treated already. Overall 47.77 % of patients showed a single lesion, 22.62 % displayed 2 lesions, and 14.34 % presented 3 lesions and 15.24 % had multiple lesions (≥4) on different parts of body. CL disease affected several of organs. The hand ulcers were 39.59 %, face ulcers (22.92 %), feet ulcers (11.51 %), hand/leg ulcer (9.09 %), face/hand ulcers (7.47 %) and other places were 9.39 % (Tables 1, 2). It's revealable the hand ulcers in either ZCL or ACL were

Fig. 1 Map of Firouzabad and Ghirokarzin districts, southern Iran

Table 1 Frequency distribution of ACL disease according to variables of 2006–2014 data related to Firouzabad and Ghirokarzin regions south of Iran

Parameter	Stratify	Number		Total (%)
		Firouzabad	Ghirokarzin	
Gender	Male	41	140	181 (46.29)
	Female	48	162	210 (53.70)
Population	Rural	30	192	222 (56.77)
	Urban	59	110	169 (43.22)
Age group	1–9	23	93	116 (29.66)
	10–19	27	64	91 (23.27)
	20–29	17	58	75 (19.18)
	≥30	22	87	109 (27.87)
Season	Autumn	47	143	190 (48.59)
	Winter	16	91	107 (27.36)
	Summer	9	32	41 (10.48)
	Spring	17	36	53 (13.55)
Place of lesion	Hand	32	124	156 (39.89)
	Face	19	90	109 (27.87)
	Leg	10	22	32 (8.18)
	Hand/leg	11	17	28 (7.16)
	Hand/face	11	24	35 (8.95)
	Others	6	25	31 (7.92)
Number of lesion	1	28	170	198 (50.63)
	2	29	57	86 (21.99)
	3	18	27	45 (11.50)
	4	7	19	26 (6.64)
	>4	7	29	36 (9.20)
Occupation	Student	30	61	91 (23.27)
	Farmer	18	57	75 (19.18)
	Housekeeper	20	74	94 (24.04)
	Worker	10	63	73 (18.67)
	Employee	3	19	22 (5.62)
	Others	8	28	36 (9.20)
Size of lesion	1	37	161	198 (50.63)
	2	35	104	139 (35.54)
	3	9	19	28 (7.16)
	≥4	8	18	26 (6.64)
		89	302	391

All size of lesions measured on “Cm” unit

Table 2 Frequency distribution of ZCL disease according to variables of 2006–2014 data related to Firouzabad and Ghirokarzin regions south of Iran

Parameter	Stratify	Number		Total (%)
		Firouzabad	Ghirokarzin	
Gender	Male	75	223	298 (49.74)
	Female	63	238	301 (50.25)
Population	Rural	80	311	391 (65.27)
	Urban	58	150	208 (34.72)
Age group	1–9	32	141	173 (28.88)
	10–19	40	97	137 (22.87)
	20–29	27	99	126 (21.03)
	≥30	39	124	163 (27.21)
Season	Autumn	65	217	282 (47.07)
	Winter	21	147	168 (28.04)
	Summer	34	56	90 (15.02)
	Spring	18	41	59 (9.84)
Place of lesion	Hand	56	180	236 (39.39)
	Face	32	86	118 (19.69)
	Leg	9	73	82 (13.68)
	Hand/leg	16	46	62 (10.35)
	Hand/face	17	22	39 (6.51)
	Others	7	54	62 (10.35)
Number of lesion	1	56	219	275 (45.90)
	2	34	104	138 (23.03)
	3	31	66	97 (16.19)
	4	11	28	39 (6.51)
	>4	6	44	50 (8.34)
Occupation	Student	54	82	136 (22.70)
	Farmer	25	117	142 (23.70)
	Housekeeper	24	88	112 (18.69)
	Worker	19	95	114 (19.03)
	Employee	6	21	27 (4.50)
	Others	10	58	68 (11.35)
Size of lesion	1	74	229	303 (50.58)
	2	47	185	232 (38.73)
	3	11	27	38 (6.34)
	≥4	6	20	26 (4.34)
		138	461	599

higher than others parts of body. There was showed a significant relationship between number of lesion and places ($p = 0.006$) and also it distinguished between season and type of lesion ($p = 0.001$). The highest prevalence (47.67 %) occurred in the autumn season. Both of them (ZCL and ACL) had this attitude. 60.50 % of patients were with wet lesions and 39.49 % were with dry lesions. No statistically significant different was observed between the

type of lesion and the sex, age or size of lesion. Almost two-third of patients was belonging to Ghirokarzin region. In addition to, over 500 individuals diagnosed with wet lesion of ZCL disease that mostly originated from rural areas of Ghirokarzin. The size of the lesions varied from 1 to more than 4 cm. Overall 88.07 % patients were within smaller 2 cm size of lesion. 24.67 % patients had the history of travel to the known endemic areas of leishmaniasis. 6.22 % cases were infected to ACL disease in their family.

Discussion

In previous studies has shown that *Phlebotomus* (*Phlebotomus*) *papatasi* species was the main vector for cutaneous leishmaniasis (ZCL) and *Phlebotomus* (*Paraphlebotomus*) *sergenti* was for ACL disease in the south of Iran (Parvizi et al. 2003; Azizi et al. 2012). It is obvious, a reduction in the number of CL disease patients during study period (2006–2014) in Ghirokarzin and Firouzabad districts, Fars province, south of Iran (Fig. 2). In this research, the maximum of patients consists of ZCL disease. This finding perhaps due to proximity of reservoirs burrows (*Nesokia indica* and *M. libycus erythrorus*) to human environment, increased agricultural activity and extension of rural areas, whereby they caused maintenance the disease in this zone and provided human to contact with rodent-sand fly straightly (Rassi et al. 2006). Moreover urbanization, landscape modification, deforestation and vector domestication were proposed as factors that usually associated with leishmaniasis in endemic countries (Shaw 2007; Desjeux 2001; Ashford 2007). There was a significant relationship between places and incidence of disease ($p = 0.006$). The patients that lived in rural areas have to work in farms or exposure to colonies of rodents and infected flies. Covering hands can be preventive factor to this disease because sandflies cannot bite body to suck the Blood over on clothing (Nazari et al. 2012; Youssefi et al. 2011). Nevertheless, travel to endemic areas one of agents in which could be exposed to vector bite as a result incidence of disease (Desjeux 2001). This was reported in previous studies (Zahirnia et al. 2009; Magill 2005). There was a correlation was presented between the season and type of lesion ($p = 0.001$). In this investigation incidence of disease was increased in the autumn season (47.67 %). This result refers to the activity of sand fly during the September–December period, the same as other previous studies (Khosravani et al. 2014; Mohammadi-Azni et al.

Fig. 2 Frequency distribution of cutaneous leishmaniasis by year in Firouzabad and Ghirokarzin zones

Fig. 3 Seasonal distribution of CL cases based on year in Firouzabad and Ghirokarzin, southern Iran

2010). It is remarkable that in current investigation the seasonal transmission of disease was inclined toward to the summer and spring seasons in the latest years (Fig. 3). Approximately 62 cases were infected in their family. The man role the major reservoir in ACL disease cycle. This point can be facilitated transmission of disease upon of uncovering lesion to another member of family (Desjeux 1996). The primary age-decade group (1–9) was included the most incidence rate compare with other age groups (i.e. ≈ 30 %). Therefore this conclusion corroborates that study sites (Ghirokarzin and Firouzabad), Fars province, southern Iran are known as endemic areas (Talari et al. 2006). Many strategies were carried out to control CL disease whereas new cases are emerging from areas that used to be free of disease. Immune system performs a pivotal role in fight against disease. Leishmania (*L*) have many mechanisms to subvert host surveillance and evasion of macrophage microbial activity by altering gene expression for cytokines, chemokines, transcription factors, membrane receptors and molecules involved in signal transduction in infected cells, thereby modulating the macrophage environment to establish infection (Olivier et al. 2005). The main control method focused on vector control, control of animal reservoirs and research into potential vaccines. Recent evidence demonstrates DNA vaccine can be effective against leishmania parasite but efforts ongoing to remove many relevant challenges (Roberts 2006). Pyrethroid-impregnated nets providing additional protection reducing biting rates by up to 64–100 % (Tayeh et al. 1997). Drug-resistance to pentavalent antimonials was reported from many countries (Llanos-Cuentas et al. 2008). Combination therapy to prevent appearance of resistance (e.g. Miltefosine) can be helpful. Plan a warning system based on climate data, vegetation coverage, rodent population dynamic, mapping of cases using health mapper, GIS and Remote Sensing to be recommended to predict and prevention of ZCL disease (Remme et al. 2002).

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