

## Anthroponotic Cutaneous Leishmaniasis in Nonendemic Quarters of a Central City in Iran

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### Abstract

**Background:** The aim of this study was to determine the status of the cutaneous leishmaniasis in some nonendemic quarters in the city of Isfahan, Isfahan Province, central Iran.

**Methods:** A total of 16380 primary school students aged 6-17 years old and a total population of 2892 persons in 700 households in four nonendemic quarters were questioned and examined for the presence of ulcer or scar. Sand flies were collected using sticky paper traps.

**Results:** A rate of 4.18% for scars and 0.3% for active lesions in the primary school children were showed. The households showed a prevalence of 11.3% for scars and 0.5% for ulcers. Two thousand and seventy four sand flies were collected and 10 species were identified. The most common sand fly species in indoor and outdoor resting places was *P. sergenti*.

**Conclusion:** The present investigation revealed that Anthroponotic Cutaneous Leishmaniasis is in an epidemic status in these quarters. Human is considered the main reservoir and transmission is believed to be from human to human by *P. sergenti*.

**Keywords:** *Leishmaniasis, Cutaneous, Iran*

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### Introduction

Leishmaniasis represents a complex of diseases with an important clinical and epidemiological diversity (1). *Leishmania tropica* is one of the causative agents of cutaneous leishmaniasis (CL), a disfiguring parasitic disease that recently was found to be viscerotropic. In urban areas it is transmitted from infected individuals by the bite of phlebotomine sand flies to naïve persons (2). Two species of *Leishmania* are involved in C.L infections in Iran (3). Anthroponotic Cutaneous Leishmaniasis (ACL) is endemic in many large and medium size cities in Iran (4). Isfahan is the biggest historic, religious and ancient city in Iran. So lots of tourists visit it during the active season of sand flies. Also many people migrate from rural to this city urban areas represent a major

risk factor. ACL spreads rapidly among these people in concentrated populations, particularly under poor housing conditions, i.e. overcrowding or lack of protection from bloodsucking sand flies. In recent years, ACL has become the most important disease in some nonendemic quarters in this city and a matter of concern for health authorities. There was no accurate data on the prevalence of the disease in these quarters, therefore descriptive studies of the disease were carried out from 2000 until 2005.

### Materials and Methods

Isfahan is geographically located at 32°38' N 51°29' E, in the lush Zayandeh-Rud plain, at the foothills of the Zagros mountain range. It is situated at 1590 meters above sea level. It receives

an average of 355 mm of rain per year. The temperature ranges between 2 °C and 28 °C. The southern and western approaches of Isfahan are mountainous and it is bordered northward and eastward by fertile plains. Thus, climate of Isfahan is varied and occasionally rainy, with a precipitation average varying between 100 and 150 mm. Studies on human infection were carried out in two population groups: 1- Primary schoolchildren in four quarters (called Ebne-sina, Amir-hamzeh, Bozorgmehr and Kohe-sofhe). 2-The population that live in the same four quarters of the city (for obtaining data on human infection rate in all age groups). For the first group a list of all of the primary schools in Isfahan was obtained. Then 76 schools were selected by cluster method. Each class was visited and a list was prepared from all the students and they were questioned and examined for the presence of ulcer(s) or scar(s). For each case having ulcers or scars, a form was completed to record the necessary information such as name, address, age, sex, number of ulcer(s) or scar(s), site of ulcers or scars, date and place of acquiring the disease, and so forth. Smears were prepared from the edge of the ulcer fixed in methanol, stained with Giemsa and examined under a light microscope for morphological study e.g. numerous, size, shape of parasite (4). All the students were visited in November, December, and January. For the second group, 700 households with a total population of 2892 persons whose buildings were located near each other in each quarter were visited, all members of the households were examined, and special forms were filled out, the same as described for the students in the same months. Samples from the sores of two patients (infected in Ebne-sina quarter and they had not traveled to endemic foci for one year) were taken and were inoculated subcutaneously at the base of the tail of six white mice (5). Furthermore, 10 household dogs were physically examined for the presence of any ulcers or scars in these quarters. Buildings are made of brick and mud in these quarters. Sand flies were collected biweekly from indoors (bedroom, warehouse etc.) and outdoors

(cracks in the walls, bird holes etc.) fixed places in each four quarters using 30 sticky paper traps (castor oil coated white paper 29.7 cm x 21 cm) from the beginning (May) to the end (November) of the active season. For species identification, sand flies were mounted in puriş medium and identified after 24 h using the keys of Theodor and Mesghali (6, 7). Then they were counted and segregated by sex.

In order to determine natural promastigote infections in alimentary canal of sand flies some unfed, blood fed and semi gravid females of them from indoors and outdoors were collected by sticky paper traps and examined in a fresh drop of sterile saline (9/1000).

## Results

A total of 16380 children aged 6-17 yr in 76 primary schools were examined physically for the presence of active lesions or scars of CL. The overall scar rate was 4.18% and the prevalence of ulcers (active lesion) was 0.3%. The higher prevalence of ulcers was calculated 0.37% in eight age groups (Table 1). In children with active lesion, 75.5% had one lesion, 12.3% two lesions, 4.1% three lesions, 6.1% four lesions and 2.0% over 7 lesions. Face(41.0%), hands (27.0%), legs (25.6%) and other parts of the body (6.4%) were affected the active lesions.

All parasites were identified as *Leishmania tropica* by morphological study.

Study of household persons in the four quarters showed 11.3% for scars and 0.5% for ulcers, both higher than with what was seen for school students. The most highly infected age group was 5-9 yr with a rate of 2.4 % active lesion (Table 2). The scar rate was 1.7% for individuals under 10 years old and 12.6% for above 10 yr. The ulcer rate was 1.7% for individuals under 10 yr old and 0.3% for above 10 yr. The youngest case was an 8-month-old and the oldest was a 29-yr old woman.

In individuals with active lesion, 50% had one lesion, 35.71% two lesions, and 14.29% three lesions. Hands (34.8%), face (30.4%), legs (21.7%)

and other parts of the body (13.1%) were affected the active lesions. Parasites from two patients with ulcers were injected subcutaneously at the base of the tail of six white mice, but none of them developed infection even three months after inoculation.

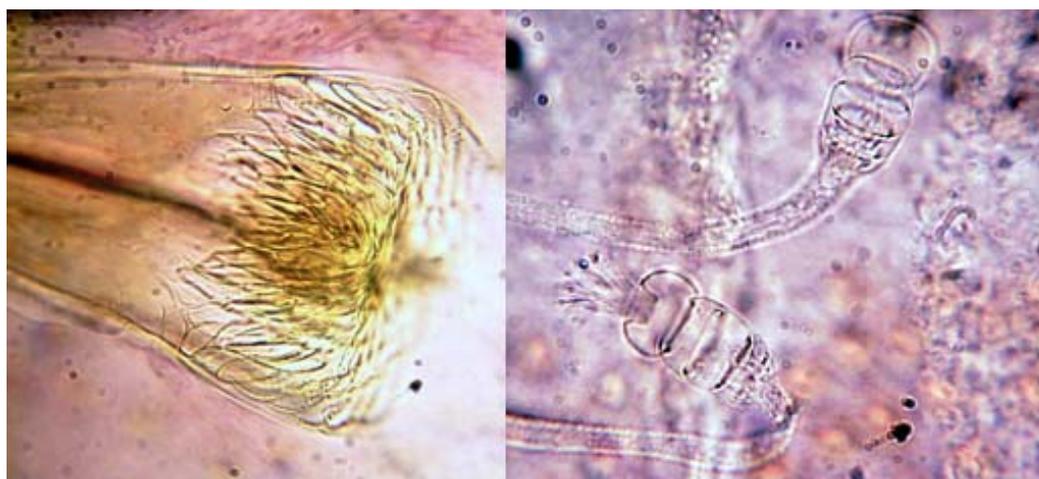
In the population survey, the scars were observed among all age groups. The  $\chi^2$  test showed statistical significant differences in the prevalence of the ulcers ( $\chi^2= 12.39$ ,  $df=1$ ,  $P= 0.0004$ ) and scars ( $\chi^2= 36.7$ ,  $df= 1$ ,  $P= 0.0005$ ) above and under of ten years old, respectively. The  $\chi^2$  test also showed non-statistical significant differences in the prevalence of the ulcers ( $\chi^2= 1.43$ ,  $df=1$ ,  $P= 0.23$ ) and scars ( $\chi^2= 2.5$ ,  $df=1$ ,  $P= 0.11$ ) by sex.

Two thousand and seventy four sand flies (1106 from indoors and 968 from outdoors) were collected and identified during this study. Seven species were found in indoors and 10 species in

outdoors in these areas of Isfahan city. The most common sand fly species in indoor and outdoor resting places was *P. sergenti* (Table 3) (Fig. 1).

The monthly activity of *P. sergenti* in indoor resting places started to appear in April and ended in early October. This species had two peaks in indoors, one in early June and another in late August. This species had two peak activities in outdoors, one in early June and the second in the end of August. The sex ratio, i.e. number of males per 100 females of *P. sergenti*, was 224.55 and 391.85 in indoors and outdoors, respectively.

In this study, 392 species of sand flies were dissected for natural promastigote infection but none of them was infected. In addition, ten household dogs were examined and none of them appeared to be infected. Therefore, parasite characterization was not carried out.



**Fig. 1:** Microphotographies of spermatheca (right) and pharyngeal armature (left) of *Phlebotomus (paraphlebotomus) sergenti* ♀ (high magnification) from Isfahan city.

**Table 1:** Prevalence of anthroponotic cutaneous leishmaniasis in primary school children in Isfahan

Age (Yr)	No. observed	No. with Scars	(%)	No. with active lesion	(%)
6	58	0	0	0	0
7	1052	12	1.14	0	0
8	1352	10	0.75	5	0.37
9	1452	30	2.06	5	0.34
10	1577	73	4.62	4	0.25
> 11	10889	560	5.14	35	0.32
Total	16380	685	4.18	49	0.3

**Table 2:** Prevalence of anthroponotic cutaneous leishmaniasis by sex and age in four quarters in Isfahan

Age group (year)	Female					Male					Total				
	No. of observed	Scars		Active lesion		No. of observed	Scars		Active lesion		No. of observed	Scars		Active lesion	
		No.	%	No.	%		No.	%	No.	%		No.	%	No.	%
0-4	73	0	0	1	1.4	74	1	1.4	0	0	147	1	0.7	1	0.7
5-9	98	2	2.0	3	3.1	107	3	2.8	2	1.9	205	5	2.4	5	2.4
10-14	141	12	8.5	1	0.7	183	10	5.5	1	0.6	324	22	6.8	2	0.6
15-19	181	21	11.6	1	0.6	187	25	13.4	1	0.5	368	46	12.5	2	0.5
20-24	161	14	8.7	0	0	170	23	13.5	0	0	331	37	11.2	0	0
≥ 25	744	122	16.4	3	0.4	773	93	12.0	1	0.1	1517	215	14.2	4	0.3
Total	1398	171	12.2	9	0.7	1494	155	10.4	5	0.3	2892	326	11.3	14	0.5

**Table 3:** Sand fly species collected from indoors and outdoors in Isfahan

Collection sites		<i>P. sergenti</i>	<i>P. papatasi</i>	<i>P. caucasicus</i>	<i>P. kandelakii</i>	<i>P. alexandri</i>	<i>S. sintoni</i>	<i>S. pawlowsky</i>	<i>S. dentata</i>	<i>S. clydei</i>	<i>S. baghdadis</i>	Total
Indoors	No.	544	329	161	27	24	13	8	0	0	0	1106
	%	49.2	29.7	14.6	2.4	2.2	1.2	0.7	0	0	0	53.3
Outdoors	No.	546	280	67	19	20	19	12	3	1	1	968
	%	56.4	28.9	6.9	2.0	2.1	2.0	1.2	0.3	0.1	0.1	46.7
Total	No.	1090	609	228	46	44	32	20	3	1	1	2074
	%	52.6	29.4	11.0	2.2	2.1	1.5	1.0	0.1	0.05	0.05	100.00

## Discussion

*L. tropica* has a wide distribution in the Mediterranean, to the west of India and is probably an anthroponotic infection in most areas (2). Examination of several isolates from human has revealed that the causal organism was also *L. tropica* in the cities of Shiraz, Tehran, Bam, Yazd and Isfahan in Iran (4).

The distribution of active cases in all parts of Isfahan city suggest that most of the cases belong to the boarder parts where new houses are being built and also belong to the parts where lots of

old mud houses are made of sun-dried bricks. These boarder parts and the old mud houses are very suitable breeding and resting places for sand flies especially *P. sergenti* and *P. papatasi*, the main vectors of cutaneous leishmaniasis (2). Most probably, *P. sergenti* is the vector (probable vector), because 49.2% of indoor and 56.4% of outdoor sand flies were of this kind of species in these quarters of Isfahan (Table 3) and in all parts of this city (8). *P. papatasi* roles as the second common sand fly in Isfahan city. In addition, *L. tropica* is the main agent of cutaneous

leishmaniasis by morphological study and ELIZA tests (4, 9).

CL is in endemic form with low endemicity, otherwise we would have seen higher scar rates. In addition, the present investigation revealed that the rate of active lesion was similar in all ages and sexes and it indicates that the disease is in an epidemic status and human is the main reservoir and transmission is believed to be from human to human in these quarters in Isfahan.

In conclusion, an epidemic of anthroponotic cutaneous leishmaniasis by *L. tropica* and man as the sole source of infection for the *P. sergenti* is going to be emergence in these quarters in Isfahan.

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