Epidemiological features of leishmaniasis and implications for public health in the eastern region of Morocco

Ibrahim Mouloudi1,2*, Naoual Zitouni1, Hind Himi2, Ussumane Injai2, Abderrahim Toumi2, Ilyesse Rahhou1,2 and Boucrah Legssyer1

1 Faculty of Science, Mohammed Ist University, Oujda, Morocco. LAPABE (Laboratory for Improvement of Agricultural Production, Biotechnology and Environment)
2 Higher Institute of Nursing Professions and Health Techniques of Oujda (ISPITSO)

Abstract. Leishmaniasis is a neglected tropical disease caused by Leishmania and is transmitted by sand fly bites. The main clinical forms are visceral leishmaniasis and cutaneous leishmaniasis. In Morocco, leishmaniasis is a public health problem, especially in the eastern region. This study aimed to provide an overview of the current epidemiological situation of leishmaniasis in this region and to assess its public health implications. A retrospective epidemiological study was conducted in the eastern region, covering six years from 2016 to 2021. The data were extracted, completed and cleaned from the leishmaniasis case registry of the Directorate of Epidemiology and Control of Leishmaniasis of the Ministry of Health and then synthesized. The epidemiological results showed that in the eastern region, the majority of cases involved cutaneous leishmaniasis caused by Leishmania major (89.45%). These cases are distributed throughout the year, with peaks in autumn (October and November) and winter (January and February). Males are more susceptible than females, with a prevalence of 57% compared to 43%, mainly in the young population (70% of cases are under 40 years of age) and in rural areas (86%). Lesions are mainly found on exposed parts of the body, mainly on the upper limbs (46.51%). Clinically, lesions were most frequently found on the upper limbs (46.51%), followed by the lower limbs (21.39%), the face (15.8%), both the lower and upper limbs (12.09%), the face with the upper limbs (3.2%) and the whole body (0.39%). The results highlight the need to strengthen prophylactic measures, particularly the importance of seasonal surveillance and interventions during the seasonal peaks observed in autumn and winter, given the challenges in rural areas, and the importance of protective measures such as clothing or repellents, including the provision of valuable medical treatment for exposed parts of the body. Keywords: leishmaniasis, Asian, epidemiology, eastern Morocco.

1 Introduction

Leishmaniasis is a vector-borne disease caused by flagellate protozoa belonging to the genus Leishmania [1]. Leishmaniasis is transmitted to humans by more than 90 different species of sandflies [2] and is ranked as the second most fatal neglected tropical disease after malaria in terms of fatality. With 350 million people considered to be at risk, it is estimated that approximately 1.3 million new cases of leishmaniasis occur each year, making it the ninth highest burden of infectious disease and the second and fourth most common causes of death and illness, respectively, among tropical infections. The clinical manifestations of human leishmaniasis are very diverse, although two main clinical forms are widespread throughout the world: cutaneous leishmaniasis is the most common form of the disease, but visceral leishmaniasis is the most serious and is almost always fatal if left untreated. Morocco has been classified by the WHO as a country with a high burden of LC and VL, with an incidence rate of 5.62 for LC and 0.91 for VL and a population at risk of 14% for LC and 10% for VL [3]. The complexity of the transmission cycle and the influence of environmental factors make epidemiological surveillance and control extremely difficult using conventional surveillance tools [4]. These persistent epidemiological uncertainties highlight the importance of taking stock of the current epidemiological situation of leishmaniasis in the eastern region, one of the main endemic areas of the disease in our country, studying the public health implications and drawing up recommendations for prevention and improved management.

2 Materials and Methods

A retrospective study was conducted by extracting statistics from the leishmaniasis control programme in the eastern region from the Directorate of Epidemiology and Disease Control (DELM), MOHSP (Rabat). The statistics, which cover cases from 2016 to 2021, were extracted from the leishmaniasis case register, cleaned, completed and synthesized into univariate and bivariate descriptive and differential statistics. The study
recorded demographic data and clinical details, including age, sex, sociogeographic status (rural or urban origin), date of onset of lesions, date of consultation, number and site of lesions and history of travel to an endemic locality. Treatment indications vary according to the clinical form, including the size, number and location of lesions, the Leishmania species involved and the immunological status of the patient. Treatment options for CL lesions may differ according to the recommended protocols for CL treatment (MoH 2010), suggesting the use of peri-lesional injections and systemic therapy. Descriptive statistical analysis was performed to assess variables and trends, such as the means, medians and standard deviations. The study analysed variance and proportions. The chi-square test was used to determine associations between potential risk factors, such as age, sex and annual variation, and the frequency of occurrence and distribution of lesions. The data were analysed using Excel and SPSS (version 26). A p value of 0.05 was considered to indicate statistical significance.

3 Results

The majority of the localities most affected were in rural areas (R) (86%), while urban areas (U) accounted for only 14% of the cases.

The annual distribution of leishmaniasis cases in the eastern region (Morocco) from 2016 to 2021 (Figure 2) revealed that the total number of leishmaniasis cases collected was 995. The highest rate of infection was observed in 2018, with 240 cases, 148 of which occurred in Figuig alone. The lowest rate was recorded in 2021, with 104 cases. The province of Figuig recorded a high number of cases (55.58%), particularly the Bouanane commune (184 cases), followed by the province of Jerada (34.17%), particularly the Ouled Sidi Abdelhakem (OSA) commune (241 cases) (Figure 1). However, the lowest incidence rates of leishmaniasis were recorded in the provinces of Nador, Driouch, Berkane, Taourirt and Guercif, with percentages of 5.93%, 2.81%, 0.70%, 0.40% and 0.40%, respectively.

This study examined the monthly distribution of leishmaniasis cases over a six-year period from 2016 to 2021. The results showed a variation in leishmaniasis cases, with peaks in the autumn and winter seasons (November, December, January, February). In contrast, the spring and summer had low case rates. Interestingly, the incidence of leishmaniasis peaked in November and December of 2018, while January and February had the highest values in 2019 (Figure 3).
(15.8%), both the lower and upper limbs (12.09%), the face in combination with the upper limbs (3.2%), and the whole body (0.39%) (Figure 4).

The chi² independence analysis of the association observed between the type of leishmaniasis was statistically significant (p<0.05), mainly related to observed between the type of leishmaniasis was statistically significant (p<0.05), mainly related to lesions in affected patients in the eastern region of Morocco (2016-2021).

This underscores the importance of considering geographical location, temporal variations, environmental conditions, and gender disparities in understanding and addressing the prevalence and distribution of leishmaniasis.

4 Discussion

Our results showed that the majority of cases were cutaneous leishmaniasis due to *Leishmania major* (89.45%), which is a type of rural leishmaniasis (p<0.01), followed by cutaneous leishmaniasis due to *Leishmania tropica* (9.5%), which is an urban and peri-urban leishmaniasis. This could be explained by the fact that the cohabitation of the rural population with animals increases the risk of bites from hematophagous female sandflies [5]. In addition, the cases recorded had a dispersed communal distribution, dominated by the provinces of Figui (55.58%) and Jerada (34.17%), which had maximum rates of 148 and 71 cases, respectively, of LC in 2018 and minimum rates of 57 and 43 cases, respectively, in 2021. These results are historically similar to those reported in various epidemiological and public health bulletins in previous years [6]. This difference in the number of cases is attributed to various natural and human factors, including the size of the surface area of the provinces affected, the omnipresence of the rural population and the semiarid climate, all of which are conducive to the multiplication of sandflies. In addition, other interfering factors, namely, altitude and human activities (e.g., deforestation, agriculture, urbanization, construction and irrigation), have been blamed for having a direct impact on the flora and fauna and consequently influencing the density and abundance of sandflies as well as the number and diversity of reservoirs. In addition, poor housing conditions, inadequate sanitation, malnutrition, poverty and population migration are considered to be the main risk factors [7]. The monthly distribution shows that there is a fluctuation in leishmaniasis cases, with peaks in two seasons (autumn and winter). This result can be explained by the presence of vectors and reservoirs, which are mainly linked to climatic conditions. The same observations were made in the study conducted by Zait and Hamrioui in 2009, who explained that the seasonal effect of leishmaniasis cases was linked to the seasonal dynamics of the vectors and the incubation.
period of the disease, i.e., the signs of the disease (skin lesions) appear one to two months or more after the infecting bite by female sandflies. In Algeria, sandflies have different peaks of activity, depending on the species and region of interest, with the peak occurring in the summer and autumn [8,9]. This study revealed that the age group most affected was the under 10s (200 patients), which is in line with the results of other studies showing that CL lesions mainly affect preschool children [2].

This hypothesis is supported by a recent study conducted by Abou-Elaaz et al. (2019) in Morocco, which showed that the age range at risk remained relatively the same during each year of the study in the province of Azilal. This may be explained by a less developed immune system in this age group, unlike adults who have developed immunity to the disease following previous exposure to the parasite at a specific time in their life.

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In Azilal, children under the age of 9 were the most affected group, while in the provinces of Béni Mellal and Fquih Ben Salah, the age groups were wider and fluctuated considerably. According to the same authors, this could be due to the acquisition of protective immunity against the parasite, as the disease is ancient in the Azilal focus, unlike in Béni Mellal and Fquih Ben Salah, where the disease is emerging [10].

In this study, we showed that the male population (57%) is more at risk than the female population (43%) based on studies conducted in Algeria [11]. In other countries, such as the Islamic Republic of Iran [12], Abdellatif et al. (2013) and Al-Warid et al. (2017) have shown a clear predominance of males in Libya and Iraq, respectively. This can be explained by the fact that men are more exposed to sandfly bites due to various factors, including their participation in outdoor activities.

During the summer months, men tend to have more exposed skin due to their clothing habits (especially in agriculture), while women spend most of their time indoors wearing long and covering clothes. Additionally, certain human behaviors can increase or decrease exposure to sandflies over time [1].

In fact, during the summer period when the temperature inside the house is too high, some male residents prefer to sleep outside the courtyards, which increases their vulnerability to the risk of sandfly bites. Our study revealed that the lesions were mainly located on the uncovered parts of the body (accessible to the sandfly vector), mostly on the upper limbs (46.51%) and lower limbs (21.39%). Our results are consistent with those of other studies showing that LC lesions in L. major are located in the upper and lower limbs, unlike those in L. tropica. Indeed, studies in Ecuador and Tunisia have shown that LC lesions caused by L. tropica are mainly located on the face and then on the upper limbs, while those caused by L. major are preferentially located on the upper and lower limbs [13,14]. This can be attributed to the sandfly vectors of L. major CL: Phlebotomus papatasi. In addition, the force of transmission of this form, which is considered more important, leads to a greater risk of suffering several infectious bites at different sites over a short period before the establishment of a protective immune response [13,15].

5 Conclusion

As a result of the efforts of the Ministry of Health, leishmaniasis continues to pose a real public health problem in our country, particularly in the eastern region. Indeed, the different structures involved in the fight must multiply and strengthen prophylactic measures through the fight against the reservoirs and vectors of the parasite.

The present study represents a contribution to the fight against leishmaniasis, which is a major concern in our eastern region (Morocco), through an epidemiological study of cases in this region and an entomological study of the involved vectors (sand flies) in the city of Oujda. The results of the study allowed us to conclude that cases of cutaneous leishmaniasis are distributed throughout all seasons of the year, with peaks observed in autumn and winter. Children under the age of 10 are most affected, and men are more likely to be affected than women are, with a prevalence of 57% versus 43%, respectively.

These analyses are valuable for improving future public health strategies aimed at controlling leishmaniasis. In short, the following recommendations can guide decision-makers to overcome the endemicity of the Leishmaniasis cycle in the eastern region and to open other avenues of research.

1. Efforts to determine the physical factors involved in the fight against leishmaniasis (elimination of manure deposits, drainage of stagnant water, etc.)
2. Restrictor indoor breeding, particularly in urban and peri-urban areas.
3. Epidemiological assessments were carried out to map infection foci and calculate the real impact of leishmaniasis based on accurate studies of prevalence and incidence.
4. Interregional coordination for significant outbreaks of the disease can be promoted by strengthening collaboration between regions that have common outbreaks.
5. Peripheral health centers should be equipped to provide appropriate diagnostic and treatment services for patients.

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