Retrospective Study of Visceral Leishmaniasis in the Health District of Léré in Chad, Central Africa

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Abstract

Visceral leishmaniasis is a neglected tropical disease that is inevitably fatal without treatment, but early diagnosis and treatment can cure patients. It largely affects people living in underdeveloped countries and is the second leading cause of mortality from parasitic infection after malaria with 20,000 to 40,000 deaths per year. To assess the epidemiology of visceral leishmaniasis in Chad, we performed retrospective study in the health district of Léré in the southwest of the country area by extracting data from the laboratory records diagnosed visceral leishmaniasis cases between January 2015 to December 2019. Between 2015 and 2019, a total of 1,141 patients were tested for Visceral leishmaniasis in the laboratory of Léré district hospital, with a prevalence of 30% (n=345) among suspected cases. The majority of the positive patients were male (61%) and the peak reporting period of cases was between March and October. The lack of awareness of Visceral leishmaniasis, the underreporting of cases and the increasing incidence recorded at a health facility in Chad, highlight the need for strengthening Visceral leishmaniasis surveillance and case detection capacity in region. To develop appropriate prevention and control strategy of visceral leishmaniasis, further study is needed to characterize the distribution of visceral leishmaniasis and its transmission in the country.

Background

Visceral leishmaniasis (VL) is a neglected tropical disease that is potentially fatal. It largely affects people living in underdeveloped countries and is often associated with malnutrition, population displacement, poor housing and weak immune systems (Okwor and Uzonna 2016; Okindo et al. 2016). Also known as Kala-azar, VL is the second leading cause of death from parasite infection after malaria with 20,000 to 40,000 deaths per year (Alvar 2012). It is characterized by a long oscillating fever, poor general condition, weight loss, immunosuppression, and enlarged spleen and liver, hence the name VL. Without treatment, it is inevitably fatal, though with early diagnosis and treatment, virtually all patients can be cured.

VL is caused by protozoa of the *Leishmania donovani* complex transmitted by the bite of sandflies, of the genus *Phlebotomus* in the Old World and *Lutzomyia* in the New World. The two-pathogen species responsible for VL are *Leishmania donovani* and *Leishmania infantum* (*L. infantum*). *L. infantum*, a zoonotic species, is responsible for the disease in countries in the Mediterranean Basin, in the Middle East and in Brazil, while *Leishmania donovani*, an anthroponotic species, is the main cause for VL in Southeast Asia and East Africa (Alvar 2012; Aubry et Gaüzère 2018).

VL is endemic in 75 countries with annually 50,000 to 90,000 new cases and approximately 20,000 to 40,000 deaths (Leta et al. 2014; Who 2017; Tedla et al. 2018). More than 90% of the annual incidences occur in seven countries only, namely India, Brazil, Kenya, Somalia, Sudan, South Sudan and Ethiopia (Leta et al. 2014; Tedla et al. 2018). In Africa, the largest outbreaks are concentrated in East Africa which, after the Indian subcontinent, contributes to the global burden with 30,000–40,000 deaths per year (Leta et al. 2014; Tedla et al. 2018).

In Chad, there is little published data on the clinical and epidemiological profile of VL. Its actual incidence is probably underestimated, as the cumulative number of cases from its first notification in 1966 to 2003 was 64. During the same period, no deaths due to the disease were reported (Sirol 1976; Desjeux 1991; OMS 2009). In 2004, a patient from Chad was diagnosed with LV in Marseille/France (Aubry 2004). In recent years, VL has reappeared and spread to some areas where it was previously non-endemic. In the health district of Léré in southwestern Chad, the number of patients diagnosed as LV-positive is increasing, however, the lack of research for in-depth knowledge of the epidemiological characteristics often delays diagnosis and treatment.

In this article, we report up to date information on VL in Chad Republic by analyzing health facility laboratory data on VL collected over the last five years in the district of Léré in Chad. The significance of the findings in strengthening VL case detection, surveillance and response are discussed in detail.

Materials And Methods

Source of data and study site

The anecdotal discussions with health information system officers on the existence of any recent VL foci in Chad led to the choice of the health district of Léré (Fig. 1) for further investigation of the disease in the country. We performed retrospective study in this area by extracting data from the laboratory records diagnosed VL cases at the District Hospital between January 2015 to December 2019. The town of Léré is the capital of the Lake Léré Department, in West Mayo Kebbi Province located at 438 km south of N'Djamena, the capital of Chad. The site is located in south-western Chad on the border with Cameroon, between latitude 9°46'12" North and longitude 14°09'00' East with an altitude of 310 m above sea level. The climate is Sahelo-Sudanian with a distinct dry season and a rainy season from April to October. Average annual rainfall varies between 700 and 800 mm with most of the rain concentrated in August. The average annual temperature is above 28°C. The coldest month is December with an average temperature of 24°C and the hottest month is April with an average of 33°C (Cheverry et Fromaget 1966; Kedeu 2006). The Léré Health District has a population of 132,413 (DSIS 2017). The majority of the population is living from agriculture, animal husbandry and fishing. The main ethnic groups are Moundang, Foulbés and Fulani. The town of Léré is situated on the shores of Lake Léré, which is the only lake in Chad to be home to a large manatee colony, making this locality an important tourist destination.

Diagnostic of VL in Léré health district laboratory

The diagnosis of VL carried out in the Léré health district was based solely on serological tests without biological confirmation in accordance with the WHO manual protocol (1996). For each patient suspected with VL, 5 ml of blood was drawn by venipuncture to perform a formalin-gel test and/or rapid diagnostic test. For the formalin-gel test, two drops of formalin are added to 1 ml of plasma. When the test is positive, the serum bleaches and solidifies to form a gel. If the test is negative, the serum does not change and both bleaching and gelling only occurs after 30 minutes. The rapid diagnostic tests were

performed according to the manufacturer's instructions (Kalazar Detect, SD Leishmania AB). The test results are reported as positive even if a faint reagent line was apparent.

Analysis of the data

The data were coded and recorded on Microsoft Excel 2010 spreadsheets. Analyses were performed using SPSS® Software, version 20.

Ethical Approval

Given the retrospective profile of the analysis of cases collected in the laboratory registry, patient consent was not obtained. However, the National Bioethics Committee of Chad approved the study protocol (N°173/PR/MESRI/SG/CNBT/2019 du 19.09.2019) and every effort was made to maintain patient confidentiality.

Results

Incidence of Visceral leishmaniasis between 2015 and 2019 at the district hospital of Léré

A total of 1,141 patients suspected of VL were diagnosed at the Léré District Hospital laboratory from 2015 to 2019, from which 345 specimens were tested positive. The highest number of cases was obtained in 2017 and the lowest in 2015. The annual number of VL cases increased during the period 2015 to 2019, particularly from 2015 to 2017 (Fig. 2). The number of VL cases was higher among males (61%) than females in all study years and also August to October cases are more frequent (Fig. 3).

Discussion

In Chad, as in most West African countries (Kone et al. 2019), the VL is very little studied and few countries regularly communicate the documents to the WHO.

We describe here the first update of VL cases in 46 years based on laboratory diagnosis at the district Hospital of Léré in southwestern Chad. Over five-year period (2015-2019), we observed an increase in the number of cases, indicating an active transmission of the disease. The increase in the number of cases could be due to the lack of control strategy to limit the spread of the disease.

In the present study, the proportion of VL positive test among clinically suspected case is 30% (345/1,141). This proportion could be even higher if other more sensitive diagnostic methods such as PCR were used, implying that the prevalence of the disease may be even higher (Sundar et Rai 2002; Chappuis et al. 2005; Antinori et al. 2007; de Ruiter et al. 2014).

Analyzing the distribution of the total number of cases, we found that the VL was predominantly male (61%). Similar results have been reported in several studies (Zijlstra et al. 1994; Malaria Consortium 2010; Hailu et al. 2016) and may be explained by socio-cultural habits of the patients. In this community,

agricultural field activities and outdoor sleeping behavior increase the exposure of men to sandfly bites than women. In our study area, males wear short trousers or sleep bare-chested, while women dress in clothing that covers the maximum body surface area.

Farming is the main activity in the study area with livestock and poultry being kept in pens near the houses creating favorable conditions for sand flies breeding site and exposing the population sleeping outdoor without bednet to high risk of VL transmission. Moreover, the high reporting period of cases is between August and November, suggesting that infection may have occurred in May-July (two to three months earlier). This period (March-May) correspond to the peak of the hot season with temperature reaching 45°C prompting people to sleep outdoor overnight, thus exposed to sandfly bites.

Conclusion

In Chad, VL is little known and poorly documented, however, the incidence of the disease is increasing in areas that were not formerly endemic. To control VL, it is necessary to strengthen diagnostic capacity (laboratory tests and training of local health workers), data reporting, and increase awareness of the disease at all levels of health facilities and communities.

The presence of healthy carriers in a population represents an important but largely neglected reservoir that perpetuates the transmission of VL. Therefore, the detection and treatment of all cases of leishmaniasis is an essential measure for any attempt to eliminate this disease.

In order to develop and implement an appropriate control strategy, further research is needed to characterize the epidemiology of VL, the transmission pattern, the identification of the vector, the parasite and the reservoir.

Declarations

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Compliance with ethical standards

Conflict of interest

The authors declare no conflict of interest. No competing financial interests exist.

Ethical Approval

Given the retrospective profile of the analysis of cases collected in the laboratory registry, patient consent was not obtained. However, the National Bioethics Committee of Chad approved the study protocol and every effort was made to maintain patient confidentiality.

References

1. Alvar J, Vélez ID, Bern C, Herrero M, Desjeux P, Cano J, Jannin J, den Boer M (2012) Leishmaniasis Worldwide and Global Estimates of Its Incidence. PLoS ONE 7(5): e35671. <https://doi.org/doi:10.1371/journal.pone.0035671>
2. Antinori S, Calattini S, Longhi E, Bestetti G, Piolini R, Magni C, Orlando G, Gramiccia M, Acquaviva V, Foschi A, Corvasce S, Colomba C, Titone L, Parravicini C, Cascio A, Corbellino M (2007) Clinical Use of Polymerase Chain Reaction Performed on Peripheral Blood and Bone Marrow Samples for the Diagnosis and Monitoring of Visceral Leishmaniasis in HIV-Infected and HIV-Uninfected Patients: A Single-Center, 8-Year Experience in Italy and Review of the Literature. Clinical Infectious Diseases 44:1602–1610
3. Aubry P (2004) Leishmaniose viscérale, cas clinique en Médecine Tropicale. Au retour du Tchad. Médecine Tropicale, texte rédigé le 20.01.2004
4. Aubry P, Gaüzère BA (2018) Leishmanioses. Médecine Tropicale, Mise à jour le 31/01/2018. PP:1-12
5. Chappuis F, Mueller Y, Nguimfack A, Rwakimari JB, Couffignal S, Boelaert M, Cavailler P, Loutan L, Piola P (2005) Diagnostic Accuracy of Two rK39 Antigen-Based Dipsticks and the Formol Gel Test for Rapid Diagnosis of Visceral Leishmaniasis in Northeastern Uganda. Journal of Clinical Microbiology 43:5973–5977
6. Cheverry C, Fromaget M (1966) Carte pédologique de reconnaissance au 1/200 000 de la république du Tchad. Feuille de Léré. Office de la Recherche Scientifique et Technique d’Outre-Mer, PP 114
7. De Ruiter CM, van der Veer C, Leeflang MMG, Deborggraeve S, Lucas C, Adams ER (2014) Molecular Tools for Diagnosis of Visceral Leishmaniasis: Systematic Review and Meta-Analysis of Diagnostic Test Accuracy. Journal of Clinical Microbiology 52:3147–3155
8. Desjeux P (1991) Information on the epidemiology and control of the leishmaniasis by country or territory. World Health Organization. WHO/LEISH/91.30
9. DSIS (2017) Annuaire des statistiques sanitaires du Ministère de la Santé Publique. Tome A 31^{ème} Edition
10. Hailu T, Yimer M, Mulu Wo, Abera B (2016) Challenges in visceral leishmaniasis control and elimination in the developing countries: A review. J Vector Borne Dis 53: 193–198
11. Keddeu P (2006) Milieux naturels et paysages du bassin-versant des lacs de Léré. (Département du Lac Léré – Tchad). Thèse de Docteur de l’Université Aix-Marseille I, PP 303
12. Kone AK, Niaré DS, Piarroux M, Izri Arezki, Marty P, Laurens MB, Piarroux R, Thera MA, Doumbo OK (2019) Visceral Leishmaniasis in West Africa: Clinical Characteristics, Vectors, and Reservoirs. Journal of Parasitology Research 8: 1-8 <https://doi.org/10.1155/2019/9282690>

13. Leta S, Dao THT, Mesele F, Alemayehu G (2014) Visceral Leishmaniasis in Ethiopia: An Evolving Disease. *PLoS Negl Trop Dis* 8:e3131 <https://doi.org/10.1371/journal.pntd.0003131>
14. Malaria Consortium (2010) Leishmaniasis control in eastern Africa: Past and present efforts and future needs. Situation and gap analysis. PP 87
15. Okindo EG, Kasili S, Kutima IHL, Mutai MJ (2016) Socioeconomic Impacts of Leishmaniasis on Households of Marigat Sub County, Baringo County of Kenya. *J Trop Dis* 4:5 <https://doi.org/10.4172/2329-891X.1000226>
16. Okwor I, Uzonna J (2016). Social and economic burden of human leishmaniasis. *Am. J. Med. Hyg* 94:489-493
17. OMS (2009) Profil épidémiologique des maladies transmissibles : République Centrafricaine et Tchad. WHO/HSE/GAR/DCE2009.2
18. Sirol J, Vedy J, Barabe P, Cesari C, Berger P (1976) Kala-Azar in the Republic of Chad. 6 year survey at the Central Hospital of N'Djamena (Fort-Lamy). *Bull Soc Pathol Exot Filiales* 69:232-237
19. Sundar S, Rai M (2002) Laboratory Diagnosis of Visceral Leishmaniasis. *Clinical and Diagnostic Laboratory Immunology* 9:951–958
20. Tedla DG, Bariagabr FH, Abreha HH (2018) Incidence and Trends of Leishmaniasis and Its Risk Factors in Humera, Western Tigray. *Journal of Parasitology Research*. <https://doi.org/10.1155/2018/8463097>
21. WHO (1996) Manual on Visceral Leishmaniasis Control. Division of Control of Tropical Diseases, Geneva. WHO/Leish/96.40.
22. WHO (2017) Global leishmaniasis update, 2006–2015: a turning point in leishmaniasis surveillance. *Weekly epidemiological record* 38:557–572
23. Zijlstra EE, el-Hassan AM, Ismael A, Ghalib HW (1994) Endemic kala-azar in eastern Sudan: a longitudinal study on the incidence of clinical and subclinical infection and post-kala-azar dermal leishmaniasis. *Am J Trop Med Hyg* 51:826-836 <https://doi.org/10.4269/ajtmh.1994.51.826>

Figures

Figure 1

Source of data and study site. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

Figure 2

Incidence of visceral leishmaniasis per year in the district hospital of Léré, Chad

Figure 3

VL cases number recorded per month from 2015 to 2019