Literature Review

Canine Leishmaniasis (CanL); a public health threat in Ghana

Abstract

Canine Leishmaniasis (CanL) is a protozoal disease caused by *Leishmania species* and transmitted by the female phlebotomine sand fly (which serves as a vector for the parasite) among animals and humans. The disease is of great importance to public health, due to its zoonotic nature, and the role of dogs as the natural reservoir of the disease. An important factor that helps in the continuous perpetuation of the parasite and for that matter the disease is the ability of the infective form of the parasite (metacyclic promastigote) to transform into amastigote in the host cells, and outsmart the host's immune mechanism. These phenomena among other factors, poses a great risk of spreading the disease to susceptible hosts (humans and animals). Three forms of the disease have been identified, namely; visceral (VL), cutaneous (CL) and mucocutaneous (MCL). Leishmaniasis control has been categorized into direct method, targeted at infectious dogs and indirect method, targeted at the vector. In conclusion, human cutaneous leishmaniasis (HCL) is endemic in certain areas of the country, however, there is no data on cases of canine leishmaniasis in the country. It is recommended that, in discussing strategies to curb human leishmaniasis, stake-holders should factor in the role of dogs and for that reason, canine leishmaniasis (CanL).

Keywords: humans, animals, canine leishmaniasis, species

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Introduction

With over 60% of pathogens causing diseases in humans being zoonotic[1] the burden of infections (diseases) in animals remain a big challenge to animal production and public health in general across the globe. One such infection, is by the parasitic protozoa *Leishmania* species. *Leishmania* infection also known as Leishmaniasis is transmitted by the female phlebotomine sand fly (which serves as a vector for the parasite) between animals and humans.[2] Leishmaniasis has been described as a neglected tropical disease.[3] Dogs serve as the main reservoir of the parasite and a key element in the spread of the disease from animal to human,[4] hence the disease is also called Canine leishmaniasis (CanL). About 13 species of *Leishmania* are reported to infect dogs globally.[5] In humans, over 20 species have been reported to be associated with the disease, with varying degrees of pathological lesions as cited by Ngouateu and Dondji.[6] In humans, leishmaniasis occurs as one of two major forms, namely; visceral (VL) and cutaneous (CL) forms.[3] Flores et al[4] however, described a third form of the disease known as mucocutaneous (MCL). Cutaneous leishmaniasis has been reported in Ghana since 1999.[3] Despite this major outbreak, and some follow-up studies which suggests the continuous existence of the disease in parts of the country, not much is being discussed about the disease in the country. Also, in spite of the established role played by dogs in the spread of the disease, there is no available data on studies of the disease in dogs in the country. This review is therefore, to take stock of leishmaniasis cases in humans and animals in Ghana, and to emphasize the risk posed by dogs in the spread of the disease. This review is hinged on data and/or literature from published studies on Human leishmaniasis (HL) and Canine leishmaniasis (CanL) in Ghana and abroad, obtained through a search in google scholar and pubmed.

Empirical review

Pathogenesis of Canine leishmaniasis (CanL)

Transmission of the disease is by the bite of infected sandflies, congenital infection, iatrogenic infection and direct dog to dog bite through wounds or bite.[7] Infected sandfly injects the infective form of the parasite (metacyclic promastigote) into a mammalian host during a bite for bloodmeal.[8] The metacyclic promastigote undergoes transformation into amastigote in macrophages in the mammalian host, outsmarting the innate immune mechanism of the host by remodelling the parasitophorous vacuole as cited by Morales-Yuste.[9] This enables the parasite to complete its life cycle and culminate in infecting surrounding cells, tissues and organs rich in macrophages like the bone marrow, liver, and spleen as cited by Gupta et al.[8] The incubation period for leishmaniasis varies from 2 weeks to several months.[10] This may then be followed by a clinical course varying from asymptomatic form to a severe generalized disease.[7] The disease may be manifested by non-specific clinical signs, and take a systemic form potentially involving many organs, tissues or body fluid.[11]

Clinical Manifestation/Signs of Canine leishmaniasis (CanL)

Canine leishmaniasis (CanL) presents a variety of clinical manifestations depending on the host's immune response including a sub-clinical and severe forms as cited by Pineda et al.[12] Clinical presentation may be cutaneous, mucocutaneous or visceral.[11] The most common clinical manifestation of the disease however, is presented in skin lesions.[7] These lesions may also include dermatitis, loss of hair, cutaneous ulcerations, ocular or nasal lesions.[13] Dogs may also present with loss of appetite, poor body condition, or cachexia.[9] In some cases, Canine leishmaniosis (CanL) may manifest clinically in the form of renal disfunction and can progress from mild proteinuria to the nephrotic syndrome or to an end stage renal disease, and in severe cases chronic renal failure or eventually death.[11] According to Morales-Yuste et al. [9] other symptoms of the disease may include, epistaxis, haematuria and haemorrhagic diarrhoea as a result of coagulation disorders associated with the disease. The cutaneous form is characterized by local, self-healing ulcerative lesions on the ears, scrotum, feet, nipples, and muzzle as cited by Sasani.[13] Other lesions include periorbital and snout the multiple foci pseudo-nodular large and small, white to grayish and or reddish.[13] Laboratory analysis of

samples may reveal nonregenerative anemia, serum hyperproteinemia, polyclonal beta and gamma hyperglobulinemia, hypoalbuminemia, decreased albumin/globulin ratio, renal azotemia, and persistent renal proteinuria as cited by Proverbio et al.[14] Histological evaluation at biopsy may reveal extensive epidermal ulceration with heavy dermal infiltration of macrophages, neutrophils and aggregates of plasma cells in response to the infection.[15] The visceral form involves multiple organs including the spleen, liver, lymph nodes, bone marrow, kidneys and skin, and may present varying symptoms depending on the affected organ.[16] Pathological lesions may include, multiple cutaneous nodules and generalized enlargement of superficial lymph nodes, mottled lungs, splenomegaly and fibrotic, cortical striation and the presence of small whitish nodular foci in the renal cortex.[16]

Risk of spread of Leishmaniasis

Over the years, there has been a considerable increase in the risk factors that contributes to the spread of leishmania infections, such as climate change, migration and the presence of Leishmania infantum-infected dogs in previously nonendemic areas.[17] According to Kweku et al.[18] epidemics of cutaneous leishmaniasis and human activities such as deforestation, construction of roads and other activities which leads to the intrusion of the habitat of the vector increases the risk of leishmania infection. Furthermore, the role of dogs in the spread of the disease among animals and humans cannot be overemphasized, as they are the primary reservoir of the parasite.[4] There is a positive correlation between an increase in the prevalence of CanL and the emergence of cases of zoonotic visceral leishmaniasis in new territories.[17] Dogs harboring leishmania species, whether they show clinical signs of the disease or not, are infectious to sand flies and may transmit the parasites.[19] Some leishmania species such as *L. tropica* are known to be associated with humans whilst others such as *L major*, *L. panamensis, and L infantum* are primarily animal parasites but can be transferred to humans.[20] In Ghana, the first report of cutaneous leishmaniasis (CL) in humans to be documented covers cases between 1999 and 2003 in the Ho municipality of the Volta Region.[3] Since then, a few more studies have suggested the presence of the disease in parts of the country. In three communities of the Oti region, Akufo et al.[3] reports of an overall prevalence of 41.8% of cutaneous leishmaniasis. In a study to assess the level of knowledge, attitude and practices among residents of some communities with records of cutaneous leishmaniasis, Doe et al.[21] reports that, 44.1% of respondents have experienced the disease. In West Africa, visceral leishmaniasis (VL) is rarely come across.[22] However, The Gambia, Senegal, and Burkina Faso have recorded Canine Visceral Leishmaniasis (CVL), whereas Niger, Nigeria, and Ivory Coast have reports of Human Visceral leishmaniasis (HVL).[23] Not only do these countries fall within the ECOWAS sub-region, but are close neighbors with whom a lot of cross-country businesses and free movement of people and goods are transacted daily, increasing the risk of spread of the disease. leishmaniasis is the dominant type of leishmania in Ethiopia, and can have a high fatality rate of up to 100% among untreated patients, as cited by Tamiru et al.[24]

Prevention and control

Leishmaniasis control methods may be categorized into two, (1) methods targeted at infectious dogs (direct control methods) and (2) methods targeted at vectors (indirect control methods).[17] With the methods targeting infectious dogs, strategies such as identification of infected dogs through surveillance/tests, vaccination of healthy dogs, quarantine of infected dogs, application of chemotherapies and euthanization of infected animals not responding to treatment would be appropriate to yield the desired result. Whilst the application of chemotherapies on infected dogs is not discouraged, the World Health Organization (WHO) recommends the reservation of antileishmanial drugs exclusively for human use only, but not for veterinary use, to minimize the development of drug-resistance among patients.[25] However, some antileishmanial drugs developed for the treatment of leishmaniasis in humans, have been adopted for use in veterinary practice as cited by Proverbio et al.[14] The use of chemical agents such as antimony compounds, metronidazole, chloroquine, emetine, tetracycline and rifampin have all yielded results in the treatment of the disease.[26] Regrettably however, some evidence of resistance to some antileishmanial drugs have already been recorded. Provebio et al.[14] in a case study reported a failure of miltefosine in the treatment of canine leishmaniasis, with success in the use of meglumine antimoniate (100 mg/kg q 24 hr for a minimum of 4 weeks). With the methods targeted at the vector, the use of repellant tools such as topical insecticides, environmental control,[17] as well as biological control strategies could also be a game changer. Above all, there is the need for public sensitization on the parasite, the role of vectors and dogs, and the disease in general.

Conclusion

Though not much data is available on the prevalence of Human Leishmaniasis in Ghana, the few studies conducted in areas with record of infection, as well as anecdotal evidences suggests the presence of the disease in the country. More worrying is the fact that, despite dogs being a reservoir for the disease, no record of a study on Canine Leishmaniasis (CanL) in Ghana was found. The leishmaniasis menace is a typical one-health problem, and needs to be approached as such. I therefore recommend that, the Ghana Health Service, Veterinary Services Directorate, Research institutions and other stakeholders should collaborate in addressing the disease.

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Conflicts of interest

The authors declare that there is no conflicts of interest.

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References

1. Rahman MT, Sobur MA, Islam MS, et al. Zoonotic diseases: etiology, impact, and control. *Microorganisms.* 2020;8(9):1405.
2. Ribeiro RR, Michalick MSM, Silva ME, et al. Canine leishmaniasis: an overview of the current status and strategies for control. *Biomed Res Int.* 2018;3296893.
3. Akuffo R, Wilson M, Sarfo B, et al. Prevalence of Leishmania infection in three communities of Oti Region, Ghana. *PLoS Negl Trop Dis.* 2021;15(5):e0009413.
4. Flores B, Mora-Sánchez B, Torres D, et al. Canine Leishmaniasis in an endemic area for human Leishmaniasis in Nicaragua. *J Trop Med.* 2022;5774296.
5. Baneth G, Nachum-Biala Y, Adamsky O, et al. *Leishmania tropica* and Leishmania infantum infection in dogs and cats in central Israel. *Parasit Vectors.* 2022;15(1):147.
6. Ngouateu OB, Dondji B. Leishmaniasis in Cameroon and neighboring countries: An overview of current status and control challenges. *Curr Res Parasitol Vector Borne Dis*. 2022;2:100077.

7. Naucke TJ, Amelung S, Lorentz S. First report of transmission of canine leishmaniosis through bite wounds from a naturally infected dog in Germany. *Parasit Vectors.* 2016;9(1):256.
8. Gupta AK, Das S, Kamran M, et al. The pathogenicity and virulence of Leishmania-interplay of virulence factors with host defenses. *Virulence*. 2022;13(1):903–935.
9. Morales-Yuste M, Martín-Sánchez J, Corpas-Lopez V. Canine leishmaniasis: Update on epidemiology, diagnosis, treatment, and prevention. *Vet Sci.* 2022:9(8):387.
10. Piscopo TV, & Azzopardi CM. Leishmaniasis. *Postgrad Med.* 2007:83(976):649–657.
11. Solano-Gallego L, Miró G, Koutinas A, et al. LeishVet guidelines for the practical management of canine leishmaniosis. *Parasit Vectors.* 2011;4:86.
12. Pineda C, Aguilera-Tejero E, Morales MC, et al. Treatment of canine leishmaniasis with marbofloxacin in dogs with renal disease. *PLoS One*. 2017;12(10):e0185981.
13. Sasani F, Javanbakht J, Samani R, et al. Canine cutaneous leishmaniasis. *Journal of Parasitic Diseases*. 2016;40:57–60.
14. Proverbio D, Spada E, Bagnagatti Giorgi G, et al. Failure of miltefosine treatment in two dogs with natural Leishmania infantum infection. *Case Reports in Veterinary Medicine.* 2014;2014.
15. Baneth G, Zivotofsky D, Nachum-Biala Y, et al. Mucocutaneous *Leishmania tropica* infection in a dog from a human cutaneous leishmaniasis focus. *Parasites Vectors.* 2014;7:118.
16. López-Peña M, Alemañ N, Muñoz F, et al. Visceral leishmaniasis with cardiac involvement in a dog: a case report. *Act Vet Scand.* 2009;51(1):20.
17. Podaliri VM, Iannetti L, Paganico D, et al. Methods of control of the *Leishmania infantum* dog reservoir: state of the art. *Vet Med Int.* 2011; 2011:215964.
18. Kweku MA, Odoom S, Puplampu N, et al. An outbreak of suspected cutaneous leishmaniasis in Ghana: lessons learnt and preparation for future outbreaks. *Glob Health Action.* 2011;4(1):5527.
19. Petersen C. Leishmaniosis in Dogs. MSD Manual. 2022.
20. Palumbo E. Treatment strategies for mucocutaneous leishmaniasis. *J Glob Infect Dis.* 2010;2(2):147–150.
21. Doe ED, Egyir YA, Kwakye NG, et al. Knowledge, attitude and practices related to cutaneous leishmaniasis in endemic communities in the Volta region of Ghana. 2019.
22. Kone AK, Thera MA, Faye B, et al. Leishmaniases in West Africa: Past and Current. *InTech Open.* 2018:77009
23. Kone AK, Niaré DS, Piarroux M, et al. Visceral leishmaniasis in West Africa: clinical characteristics, vectors, and reservoirs. *J Parasit Res.* 2019;9282690.
24. Tamiru HF, Mashalla YJ, Mohammed R, et al. Cutaneous leishmaniasis a neglected tropical disease: community knowledge, attitude and practices in an endemic area, Northwest Ethiopia. *BMC Infect Dis.* 2019;19(1):855.
25. Medkour H, Bitam I, Laidoudi Y, et al. Potential of Artesunate in the treatment of visceral leishmaniasis in dogs naturally infected by Leishmania infantum: Efficacy evidence from a randomized field trial. *PLoS Negl Trop Dis.* 2020;14(12):e0008947.
26. Bahmani M, Saki K, Ezatpour B, et al. Leishmaniosis phytotherapy: Review of plants used in Iranian traditional medicine on leishmaniasis. *Asian Pacific Journal of Tropical Biomedicine.* 2015;5(9):695–701.