KDU Journal of Multidisciplinary Studies (KJMS)
Volume 6. Issue 2 Nov 2024
DOI: https://doi.org/10.4038/kjms.v6i2.88

KJMS 2024 VOL.6 (2): 99-108

A RETROSPECTIVE STUDY ANALYSING THE PROFILE OF CUTANEOUS LEISHMANIASIS CASES REPORTED TO A BASE HOSPITAL IN THE NORTH CENTRAL PROVINCE OF SRI LANKA

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ABSTRACT

Cutaneous leishmaniasis (CL) is the most prevalent clinical form of leishmaniasis in Sri Lanka. This study explored the epidemiological characteristics of CL patients at the Base Hospital, Medirigiriya, Sri Lanka, based on retrospective data collected during 2017-2022. Specifically, it determined the frequency of CL among the patients and examined the patterns of CL distribution in the selected population concerning demographic, spatial, and temporal factors. The research used the laboratory investigation reports of clinically suspected CL patients referred to the dermatological clinic during the study period. The smear test result, age, sex, and area of residence were collected and analysed using Microsoft Excel and SPSS software. A total of 1190 residents from the Medirigiriya area suspected of CL were screened, of whom 584 (49.1%) were positive by smear test. The annual positive cases increased from 2017 (42.8%) to 2022 (55.7%). The average annual incidence of CL per 100,000 population in Medirigiriya was estimated to be 122. Among the positive patients, the percentage of males (60.6%) was higher compared to females. Also, the 41-50 age group showed the highest percentage (21.2%) of CL positive cases. The month of July recorded the highest mean number of CL-positive patients. The main cluster of CL patients was in the Nawanagaraya and Medirigiriya Grama Niladari Divisions. Sex, age, area of residence of patients, and month of the year were the significantly associated risk factors ($p<0.05$) for CL infection in Medirigiriya during the study period. This research provides an understanding of the demographic and spatiotemporal factors associated with CL in Medirigiriya during 2017-2022 which would be important in designing strategies for the prevention and control of CL in the area. It is recommended that the identified risk factors be targeted for future research, surveillance, and implementation of control methods.

KEYWORDS: *Cutaneous leishmaniasis, Leishmania, Demographic distribution, Spatiotemporal distribution, Sri Lanka*

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1. INTRODUCTION

Leishmaniasis, caused by the protozoan belonging to genus *Leishmania* and transmitted to humans by sandfly vectors *Phlebotomus* and *Lutzomyia*, is one of the seven important neglected tropical parasitic diseases (Mathers et al., 2007), with around 1–2 million new cases and an estimated 350 million people at risk worldwide annually. (Torres-Guerrero et al., 2017). There is considerable diversity in the epidemiology, clinical features, and disease severity of leishmaniasis, and these variations are attributed to both parasite and host-related factors and the ecological characteristics of the transmission site (McCall and Matlashewski, 2010; Alvar et al., 2012; Gradoni, 2018; Guery et al., 2021). The genetic diversity of the parasites and vectors (Kariyawasam et al., 2017; Pathirage, et al., 2021), limited access to advanced diagnostic tests, and the knowledge gaps in the disease and at-risk populations, vectors, and reservoir hosts (Wijerathna et al., 2017; Jayathilake and Taylor-Robinson, 2020) are some of the potential challenges identified for controlling the disease in Sri Lanka.

Of the three main clinical manifestations of the disease; cutaneous (CL), muco-cutaneous (MCL), and visceral (VL) leishmaniasis, in Sri Lanka and many other countries, the highest number of cases are reported with CL (Siriwardana et al., 2012). CL causes skin sores frequently on the forearms, legs, and face that can leave scars and result in permanent impairment. The psychosocial burden of CL is high due to the disfiguring nature of the disease and the associated stigma (Nuwangi et al., 2024). Since the first CL case resulting from local transmission was documented in 1992 (Athukorale et al., 1992), it is now widely distributed throughout the country. The island is the most recently identified endemic focus in South Asia, with rising trends in disease prevalence (Siriwardana et al., 2012; Galgamuwa et al., 2018; Karunaweera et al., 2020; Karunaweera et al., 2021). CL in Sri Lanka exhibits seasonal trends (Sandanayaka et al., 2014; Galgamuwa et al., 2018; Sudarshani et al., 2023), likely due to the availability of habitats for the sand fly vectors and environmental factors such as rainfall, temperature, wind speed, and humidity (Galgamuwa et al., 2018; Wijerathna and Gunathilaka, 2020b; Wijerathna and Gunathilaka, 2023). CL in Sri Lanka is also associated with socio-demographic and landscape factors (Galgamuwa et al., 2017; Wijerathna et al., 2020a), and a spatiotemporal expansion of the disease incidence is evident with distinct geographic patterns and disease hotspots (Wijerathna et al., 2020a; Karunaweera et al., 2020; Karunaweera et al., 2021, Jayasena Kaluarachchi et al., 2024). Thus, more research on the epidemiological determinants of leishmaniasis in Sri Lanka is necessary since the knowledge gaps complicate efforts to manage the disease.

Polonnaruwa is one of the five districts of the island with a high level of CL endemicity (Galgamuwa et al., 2018), however, the epidemiolocal profile of leishmaniasis in specific Medical Officer of Health (MOH) areas of this district is still limited, including for the Medirigiriya MOH (Sandanayaka et al., 2014). To contribute to this research gap, we aimed to explore the profile of CL patients attending the dermatology clinic of the Base Hospital, Medirigiriya, based on retrospective data collected during the period 2017-2022. The specific objectives of the study were to determine the frequency of CL patients among the study cohort and to find the patterns of CL distribution in the selected population to demographic, spatial, and temporal characteristics. An understanding of the epidemiological patterns is significant for developing effective control strategies, reducing the disease burden, and improving public health in Medirigiriya, Sri Lanka.

2. METHODOLOGY

The study was a retrospective, descriptive study of patients who had presented at the Base Hospital, Medirigiriya, with skin lesions. The study population consisted of patients referred to the dermatology clinic from January 2017 to December 2022. All patients clinically suggestive of CL (positive or negative for CL) from the Medirigiriya MOH area during the study period were included in the study. Data from those not from the Medirigiriya MOH area were excluded from the analysis.

Ethics approval

Ethical approval for the study was obtained from the Ethics Review Committee of The Open University of Sri Lanka (FH/ERC/22). The administrative approval for the study was obtained from the Regional Director of the Polonnaruwa district and the Medical Superintendent of the Base Hospital, Medirigiriya. Participants were not directly approached for data collection, only the laboratory reports were utilized for the study. A reference number was given for each patient report, and data were collected without the identification of the person.

Data collection and analysis

The sample included data from laboratory investigation reports for Giemsa-stained touch or impression smears for CL. The date of the report, smear test result, age, sex, and area of residence were extracted from the reports. The data were analysed with Microsoft Excel and SPSS version 23 software. Descriptive statistics and frequency distributions were used to present the CL-positive cases with respect to sex, age, and other characteristics. The annual incidence of CL cases per 100,000 population in Medirigiriya was estimated using the population data for the area obtained from the MOH office in Medirigiriya. The spatial distribution of CL cases in the MOH area was analysed based on the number of cases reported to the hospital from each Grama Niladari (GN) Division of the MOH area. Data were analysed for temporal variations in CL based on monthly and annual CL confirmed cases reported at the hospital during 2017-2022. The trends in CL cases during the six years were analysed in relation to demographic, spatial, and temporal characteristics using the chi-square test. A $p<0.05$ was considered statistically significant.

3. RESULTS

A total of 1190 records of clinically suspected CL patents of the Medirigiriya MOH area were collected from the laboratory reports.

Frequency of CL patients

A total of 584 (49.1%) screened patients were positive for CL.

There was a continuous increase in CL patients from 2017 to 2022 (Figure 1).

The number of individuals screened for CL at the Base Hospital, Medirigiriya, increased from 35 to 339 over the six-year period. The number and percentage of CL-positive cases also showed a continuous increase from 2017 (15, 2.6%) to 2022 (189, 32.4%). The annual incidence of CL cases in Medirigiriya was estimated to increase from 19 to 239 cases per 100,000 individuals for the period 2017 to 2022.

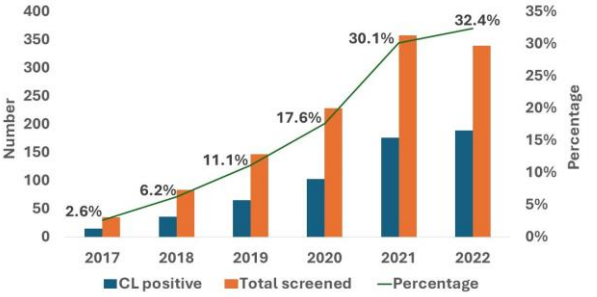

Figure 1: Distribution of CL patients at Base Hospital, Medirigiriya, from 2017 – 2022

Demographic characteristics of CL patients

Sex profile

Among the 584 CL positive cases (Table 1), the majority were male (62.3%). Of the 691 male patients screened for CL, 364 (52.7%) were positive. Among the 499 female patients screened for CL, 220 (44.1%) were positive. CL positivity was higher in males than in females in all study years ($p<0.001$). Findings showed a gradual increase in the number of male and female CL patients over time, with the highest number of male (n=125) and female (n=69) cases in 2022 and 2021, respectively.

Table 1: Distribution of male and female CL patients during 2017 - 2022

Year	Number (%)				
	Positive for CL		Negative for CL		Total
	Male	Female	Male	Female	
2017	13 (37.1)	2 (5.7)	14 (40)	6 (17.1)	35
2018	21 (25.3)	15 (18.1)	37 (44.6)	10 (12.0)	83
2019	37 (25.2)	28 (19.0)	40 (27.2)	42 (28.6)	147
2020	61 (26.8)	42 (18.4)	60 (26.3)	65 (28.5)	228
2021	107 (29.9)	69 (19.3)	100 (27.9)	82 (22.9)	358

2022	125 (36.9)	64 (18.9)	76 (22.4)	74 (21.8)	339
Total	364 (30.6)	220 (18.5)	327 (27.5)	279 (23.5)	1190
Mean	60.7	36.7	54.5	46.5	198.3
SD	46.2	26.7	30.7	32.7	133.3

SD: standard deviation

Age profile

The majority (54.3%) of CL patients were in the 31-60 years age group, with the highest (21.2%) in the 41-50 group (Figure 2). There were no positive patients <1 year of age. The lowest percentage of cases (0.68%) was in the age group of >81 years. There was a significant variation in the age distribution of CL patients between 2017-2022 ($p<0.001$).

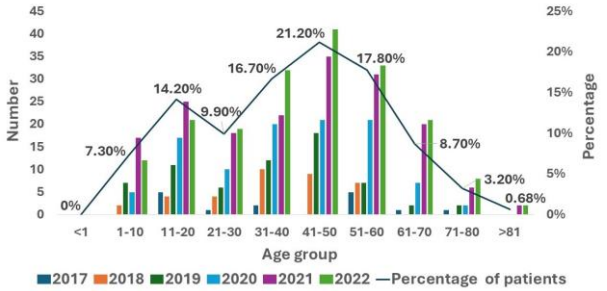

Figure 2: Distribution of CL patients based on age

The males and females showed a similar pattern of variation in CL with age, with the highest numbers in the 41-50 age group of both sexes (Figure 3).

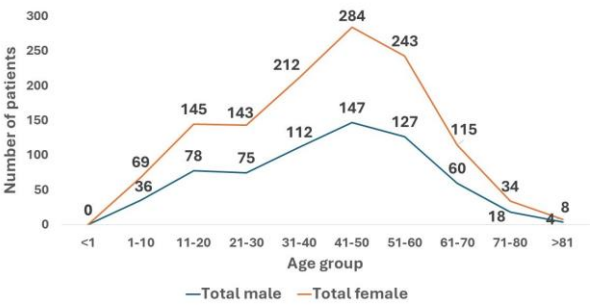

Figure 3: Distribution of CL positive males and females with age

Monthly distribution of CL patients

The total number of CL positive patients varied significantly across the months between 2017-2022 ($p<0.001$), with July showing the highest numbers (n-119; 20.4%) in all six years (Figure 4). A similar trend was observed for the monthly distribution of CL patients when considering individual years as well, where the July peak was consistent in all years, with a possible second peak in April and October in some years (Figure 4).

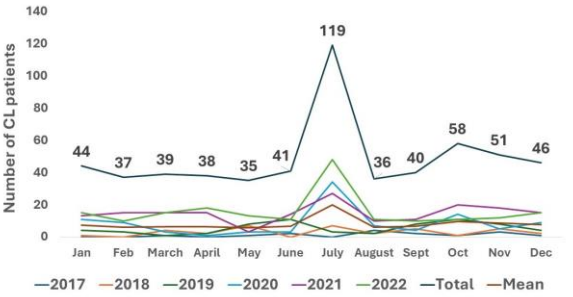

Figure 4: Monthly variation of positive CL patients across the six years

Spatial distribution of CL patients

The highest percentage of positive cases was reported from the Nawanagaraya GN division, followed by the Medirigiriya GN division (Figure 5). The total number of patients reported from these two GN divisions for the six-year period was >100. Out of the 45 GN divisions, 13 did not show any CL cases, while others showed at least a single patient. The variations in the spatial distribution of CL patients in the different GN divisions between 2017-2022 were statistically significant ($p<0.05$).

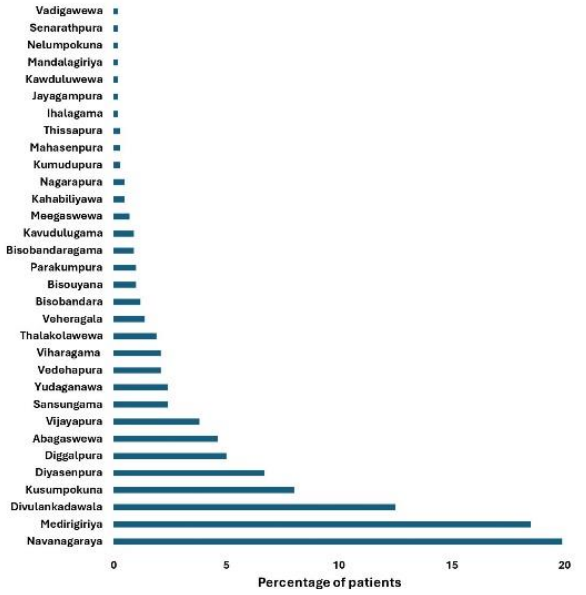

Figure 5: Spatial distribution of CL patients in GN divisions of Medirigiriya during 2017-2022

4. DISCUSSION

This retrospective study determined the frequency of CL among patients reporting to the dermatology clinic at the Base Hospital, Medirigiriya, and assessed the patterns of CL distribution in the selected population with respect to demographic, spatial, and temporal characteristics. Of the total 1190 clinically suggestive cases screened by skin smears between 2017 and 2022, from which 584 (49.1%) were reported as positive. The total number of tested cases as well as positive cases were observed to gradually increase over the years. Several reasons may have contributed to this increasing trend in the number of CL positive patients and the referred number of patients during the six-year study period. The number of patients referred for CL screening may have increased from 2017 onwards because the services of a dermatologist became available at the Base Hospital only in that year. Also, with time, the community would have become more aware of the disease, resulting in more individuals in Medirigiriya visiting the hospital for treatment.

In a previous study, the Medirigiriya MOH area in Polonnaruwa reported an incidence of 8–41 CL cases per 100,000 population (Sandanayaka et al., 2014). In comparison, our study reported an increased mean annual incidence of 121 cases per 100,000 population for the 2017-2022 period. CL is more distributed among people living in poverty (Firouraghi et al., 2023) and increases in incidence are likely to be connected to several reasons, such as, low income and lack of awareness of the disease or low education level (Wijerathna et al., 2020a; Dewasurendra et al., 2024), conducive climate and landscape (Wijerathna et al., 2020a; Maia-Elkhoury et al., 2021; Coates and Norton, 2021; Mohammadbeigi et al., 2021; Hassanein et al., 2023), population migrations and behaviours that increase exposure to vectors (Chaves et al., 2008; Dewasurendra et al., 2024) and the presence of animal reservoirs and breeding and resting places for the vectors (Feliciangeli, 2004; Wijerathna et al., 2020). Medirigiriya is an area with a hot and humid climate with many low-income people in the community; some live in part-built houses, which are good breeding places for the sand fly vectors (Feliciangeli, 2004). Further, in our study, the only two GN divisions to record >100 positive cases were Nawanagaraya and Medirigiriya. Nawanagaraya is an area with high paddy cultivation and a large farming population, which may be an underlying cause for the high incident rate in that area. Medirigiriya, on the other hand, is the most urban area among the GN divisions, with a high population. We could therefore assume that these residents have a better awareness of the disease. Also, the hospital is within easy reach of this GN division. These factors may have contributed to people in this area seeking screening, increasing the number of detected CL cases in the Medirigiriya GN division. Our study is consistent with another study which had shown that early seeking of treatment was probably influenced by improved literacy, income and awareness, which would have led to improved CL diagnostic rates in a study cohort from the Southern Province, (Jayasena Kaluarachchi et al., 2024).

Among the patients that reported to the Base Hospital from the Medirigiriya MOH area, males were more likely to be CL positive compared to females, similar to the findings of studies done in Sri Lanka and other countries (Abdellatif et al., 2013; Siriwardana et al., 2019; Solomon et al., 2022; Sudarshani et al., 2023; Firouraghi et al., 2023; Sudarshani et al., 2024; Jayasena Kaluarachchi et al., 2024). The average male-to-female ratio of CL patients for the six-year period of our study was 1.7 similar to the statistics reported by Sudarshani, et al. (2019) and Silva et al. (2021). Only a minority of research from Sri Lanka (Kariyawasam et al., 2015) reported female predominance in their study cohort. This sex-based distribution among the CL patients is probable, as males are more likely to be exposed to infected sand flies because of their occupational activities in cultivation fields that provide suitable breeding and resisting habitats for these vectors. Though women also engage in the agricultural fields, they do so to a lesser extent than males, and they are also more likely to wear clothes covering the body, thus having better chances to avoid sand fly bites (Amarasinghe and Wickramasinghe, 2020; Saeidi et al., 2021). In a nationwide survey conducted in Sri Lanka, wearing protective clothing during outdoor activities was a significant factor in determining disease outcomes for males (Dewasurendra et al., 2024).

In Medirigiriya, the most affected were the 31-60 age group (54.3%), with the highest prevalence in the 41-50 group for both males and females during 2017-2022. Similarly, in some studies, the older working population was more likely to be affected by the disease (Reithinger et al., 2003; Nawaratna et al., 2007; Sandanayaka et al., 2014; Siriwardana et al., 2019; Karunaweera et al., 2020; Sudarshani 2023; Jayasena Kaluarachchi et al., 2024), but in others, the age range shifted to the <20 year-old population (Gurel et al., 2002; Hassanein et al., 2023). Similar to our findings, others also have reported that school children are at higher risk when compared to >60 age group (Dewasurendra et al., 2024; Sudarshani et al., 2024). The age groups that are more likely to engage with the outside environment get more exposed to the vectors, thus showing the highest CL positivity (Feliciangeli, 2004). In our study, the lowest number of cases were among the >80 year-old age group, while no patients were found in the <1 year of age, likely due to fewer outdoor activities. Comparatively, while some studies report that certain age groups of males show a higher CL prevalence similar to our findings (Ihsanullah et al., 2021, Jorjani et al., 2019), others report no difference between males and females and age group trends in CL positivity (Akhmedovich and Samadovna, 2022).

In our study, the monthly distribution of CL patients varied, with the highest mean number of CL cases reported in July for the six-year study period. Firouraghi et al. (2023) also reported that the number of positive cases in Iran fluctuated during the different months of the year, but the seasonal trends in CL distribution reported in different studies vary (Jorjani et al., 2019). In studies conducted in Sri Lanka during 2008-2012 (Siriwardana et al., 2012), and 2018 (Galgamuwa et al., 2018), the peak of positive cases in Polonnaruwa was reported during August-December, like the trend we observed in 2017 and 2019. In Ethiopia, the CL cases showed a sharp peak between July and September (Debash et al., 2022), but in Libya, a marked increase in numbers was observed in December (Ashour, et al., 2022). These monthly variations in CL may be attributed to environmental and ecological factors that affect sandfly breeding and cultivation activities at a site (Mohammadbeigi et al., 2021). Studies from Sri Lanka and other regions of the world have shown that climatic factors such as humidity, temperature, and rainfall can affect CL incidence either positively or negatively depending on the geographical area (Toumi, et al., 2012; Rosales, et al, 2017; Sharafi et al., 2017; Azimi et al., 2017; Galgamuwa et al., 2018; Ramezankhani et al., 2018; Wijerathna and Gunathilaka, 2023).

Our study has contributed important characteristics of the CL patients in the Medirigiriya MOH area for a six-year period, which are important for understanding the epidemiology of this disease in this MOH. We have identified a few limitations in the study that could be overcome in future work. It is possible that the frequency of CL patients is underreported here because some of the patients in the Medirigiriya MOH area may not have sought treatment at the Base Hospital, Medirigiriya, instead preferring to visit the General Hospital, Polonnaruwa, or elsewhere. Also, some of the cases may have been misdiagnosed because the CL diagnosis was determined only by microscopy due to limited resources and facilities. It is important to confirm negative slit skin smear results for CL by more sensitive and specific molecular techniques (De Silva et al., 2017) as studies have reported over 90% detection rate of CL by PCR (Kariyawasam et al., 2015; Jayasena Kaluarachchi et al., 2024), whereas slit skin smear sensitivity was reported to be 59% (Sudarshani et al., 2023). Further, the laboratory reports of the CL patients contained limited information about the patients. Therefore, we could not analyse data based on their general clinical data, occupation, anatomical distribution, morphological typing (popular, nodular, or ulcerative), etc., to obtain a clearer picture of the disease and associated risk factors.

5. CONCLUSION

This research contributes epidemiological information on the demographic, spatial, and temporal characteristics associated with CL in Medirigiriya MOH during 2017-2022. Increasing trends in disease incidence in the last six years indicate the importance of improved case detection at the community level, strict adherence to case management protocols and control activities, and continued surveillance and

monitoring for the effective management and control of leishmaniasis in the Medirigiriya MOH area. Behavioural changes and education of people to accept and participate in control programs would also be useful in this regard. Further, the identification of age and sex groups at risk, as well as the vulnerable months of the years and GN divisions, suggests that awareness programs, treatment programs, and vector control programs must be targeted in relation to these factors to control the disease. The results reported herein therefore contribute to future research about CL epidemiology and the implementation of disease control measures in the Medirigiriya MOH area of Sri Lanka.

6. ACKNOWLEDGMENT

The authors thank the Regional Director, Polonnaruwa, and the Medical Superintendent, Base Hospital, Medirigiriya, for providing approval to access the data. We thank the staff of the Public Health Laboratory, Base Hospital, Medirigiriya, for their assistance in collecting data from the laboratory reports. The Department of Medical Laboratory Sciences at the OUSL is acknowledged for providing constructive comments at the time of designing the study.

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